Electrical World

JANUARY 11, 1941

Engineering Library

37th ANNUAL STATISTICAL NUMBER

WHY ...PUSHING A BUTTON CAN NOW HEAT WATER IN 10,000 HOMES!

The home electric storage water heater is another device which has been simplified and made thoroughly practical by the unfailing contacts of the Sensitrol Relay. These heaters, equipped with Sensitrols, are controlled from the sub-station by a *carrier wave signal,* and operated during "off-peak" periods. This low impulse is sufficient to firmly close the relay contacts and thus control the "on" and "off" heater switch. Positive contact is certain . . . amplification is unnecessary . . . because of Sensitrol's *magnetic* contacting principle!

The WESTON SENSITROL RELAY

— employs an exclusive magnetic contacting principle . . . powerful magnetic contacts will positively complete a circuit of 110 volts AC or DC carrying 50 milliamperes, at operating values as low as 2 microamperes or 1 millivolt . . . no chattering or other contact troubles . . . operates directly from output of photo-cells, thermocouples, etc., without amplification . . . available with fixed or adjustable contact, manual or electrical reset . . . measures only 3¼" diameter.

WHEN *You* LAY PLANS FOR A BETTER METHOD

. . . keep in mind these unusual characteristics of the Sensitrol. They may prove the "Open Sesame" to valuable devices beyond the horizons of known designs. Combining *high sensitivity* with *high contact capacity,* the Sensitrol already has made possible the development of simple, practical devices for controlling motors, heaters, traffic lighting, safety alarms, and for numerous other problems of control. Why not have the complete story on Sensitrol . . . learn more about its application possibilities? Ask the WESTON sales representative in your vicinity, or write for literature to Weston Electrical Instrument Corporation, 578 Frelinghuysen Ave., Newark, New Jersey.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters...Aircraft Instruments... Electric Tachometers...Dial Thermometers.

FOR OVER 32 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 67 YEARS

A. E. KNOWLTON.....*Associate Editor*
HENRY G. DOOLEY.....*Associate Editor*
G. F. WITTIG.....*Statistical Editor*
E. DALTON WHITE.....*News Editor*
CHARLES DE VORE.....*Assistant Editor*
E. M. GLENNON.....*Assistant News Editor*

BRANCH OFFICES
L. W. W. MORROW.....*Western Editorial Director*
D. T. BRAYMER.....*Western Editor*
H. S. KNOWLTON.....*New England Editor*
WAYNE SNOWDEN.....*Pacific Coast Editor*
PAUL WOOTON.....*Washington Correspondent*

FRANK R. INNES.....*Managing Editor*

S. B. WILLIAMS.....*Editor*
W. K. BEARD, JR.....*Manager*

January 11, 1941

Contents

Vol. 115, No. 2

37th ANNUAL STATISTICAL NUMBER

Highlights 79
Output 80
Capacity 82
New Capacity 85
Transmission and Substations 89
Station Economics 90
Energy Sales 92
Revenue 94
Customers 96
Peaks and Reserves 98
Expenses 100
Financing 102
Budget 104
Electrical Manufacturing 106
REA Operations 108
Outstanding Facts 109
Chronology of 1940 110
(For detailed index, see page 78)

Retrospect 113
S. B. WILLIAMS, *Editor Electrical World*

Manufacturers to Keep Pace with General Business 116
E. O. SHREVE, *President National Electrical Manufacturers Association*

Carter Field on Washington Events 120

News of the Week 121

Editorials ..... 77 and 118
Operating Practices 133
Industrial Engineering 142
New Engineering Ideas 148
Load Building 156
New Equipment 162
News About People 172
Manufacturing and Markets 186
Recent Rate Changes 192
Sales Opportunities 196
Rural Allotments 200
Letters to the Editor 206

Index of Advertisements 220

Price of this issue, $1 per copy

McGRAW-HILL PUBLISHING COMPANY, INC.

JAMES H. McGRAW, Founder and Honorary Chairman

Electrical World—Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42d Street, New York, N. Y. Subscription rates: In the United States, Canada, Mexico, Central and South American countries, $5 a year $8 for two years, $10 for three years. Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.
Contents copyrighted, 1941, by McGraw-Hill Publishing Company, Inc. Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Atlanta, Ga. Cable Address McGRAWHILL, New York.

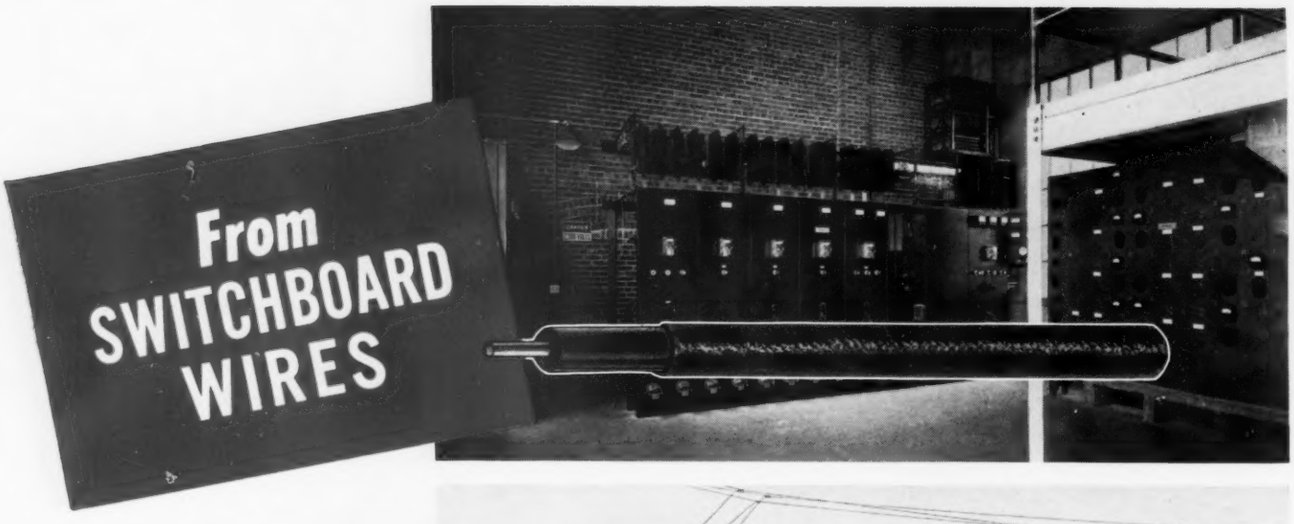
Publication Office
99-129 North Broadway, Albany, N. Y.

Editorial and Executive Offices
330 West 42d Street, New York, N. Y.

JAMES H. McGRAW, Jr.....President
HOWARD EHRLICH.....Executive Vice-President
MASON BRITTON.....Vice-Chairman
B. R. PUTNAM.....Treasurer
D. C. McGRAW.....Secretary
J. E. BLACKBURN, Jr.....Director of Circulation

Member A.B.P. Member A.B.C.

A McGRAW-HILL PUBLICATION



Specify OKONITE

The performance records of Okonite Products have earned a preferred rating throughout the electrical industry — For complete information about wires or cables for every requirement, consult the nearest branch office of

THE OKONITE COMPANY

- ATLANTA, GA
  1606 Rhodes-Haverty Bldg.
- *BIRMINGHAM, ALA.
  Comer Building
- BOSTON, MASS.
  1100 Statler Office Building
- BUFFALO, N. Y.
  44 Victoria Blvd., Kenmore
- CHICAGO, ILL.
  20 No. Wacker Drive
- CLEVELAND, OHIO
  316 National Building
- DALLAS, TEXAS
  P. O. Box 694
- DETROIT, MICH.
  1709 Ford Building
- LOS ANGELES, CALIF.
  2450 Hunter Street
- NEW YORK, N. Y.
  501 Fifth Avenue
- PHILADELPHIA, PA.
  Broad St. Station Bldg.
- PITTSBURGH, PA.
  1317 Gulf Building
- SAN FRANCISCO, CALIF.
  1664 Russ Building
- SEATTLE, WASH.
  701 Northern Life Tower
- ST. LOUIS, MO.
  Shell Building
- WASHINGTON, D. C.
  547 Munsey Building
- FACTORIES
  Passaic, N. J.
  Paterson, N. J.
  Wilkes-Barre, Pa.

Okonite's newest office to increase service for the Industrial South.

OKONITE
Insulated Wires and Cables

ELECTRICAL WORLD • JANUARY 11, 1941

VISTA

THE MOST OBVIOUS THING seen in the report of 1940 utility operations as divulged in the statistics contained in this issue is, of course, the tremendous effect of the national defense program. The year shows the largest annual increase in output, extremely rapid rise in industrial usage, greatly increased hours use of generating capacity, record-breaking commitments for additional capacity, large increase in substation construction.

Less obvious, but equally important, is the economy of the industry. In spite of lower rates, higher costs and heavier taxes, the industry through more efficient operations, and particularly by taking advantage of lower interest rates, has been able to maintain a fair return.

It is evident that the time is not far off when the economies from refinancing will not be sufficient to balance operating revenue deficiencies. The most urgent necessity is a better rate for increment business. The increment business last year, as the result of rate cuts and low steps, carried very low average rates.

Three things seem to be indicated, therefore: First, efforts should be made to build load where a better revenue will be received for the additional energy. Second, for rate cuts it might be better to substitute an annual or semi-annual customer dividend when and if earned. Third, some means must be found for automatically passing on tax increases to the customers. Fourth, classes of service should be studied for rate increases.

Fortunately, the utility industry has sufficient load-carrying capacity to take care of its peace-time as well as defense requirements so that it can balance its new business operations.

37th ANNUAL STATISTICAL NUMBER

INDEX TO 37TH ANNUAL STATISTICAL NUMBER

Electric Light and Power Industry

Page

Budget 104, 105
capital expenditures 105
by classes of construction 105
by regions 105
operating expenditures (see "Expenditures")

Capacity 82–84
generator ratings 83
by regions 83
by states 84
by types of prime movers 83

Chronology of 1940 110–112

Construction, new 85–89
generating capacity 85–88
added in 1940 86
hydro 86
internal combustion 86
steam 86
prospective for 1941 87
hydro 87
internal combustion 87
steam 87
prospective for 1942 88
hydro 88
internal combustion 88
steam 88
prospective for 1943 or later 88
hydro 88
internal combustion 88
steam 88
substation capacity, by regions 89
transmission lines, miles, by regions . . . 89

Customers 96, 97
by states 97
commercial and industrial 97
municipal, rail and miscellaneous . . . 97
residential 97
rural 97

Employees, total 101, 109

Energy output 80, 81
imports from Canada 80
generated 80
by regions 81
from steam 80
from water power 80
from internal combustion 80
losses 80
sales to ultimate consumers 80
(see also "Energy Sales")
total for distribution 80
used by producer 80

Energy sales 92, 93
to ultimate consumers 92
commercial and industrial 92
large light and power 92
small light and power 92
electric railways 92
electrified railroads 92
municipal and miscellaneous 92
municipal street lighting 92
residential 92
rural 92

Expenditures 100, 101
allocation of revenue dollar 100
capital (see "Budget")
employees, payrolls, fuel, maintenance . . 101
operating revenue, expenses and taxes . . 101
operating ratio, before and after taxes . . 101

Financing 102, 103
new utility, by type 103
security sales, by type 103
to public and institutional investors . . 103
trend of equity financing 103

Page

Outstanding facts 109

Peaks and reserves 98, 99
Federal Power Commission study of adequacy of power supply.

Revenue 94, 95
average from residential service 95
annual bill, rate and use 95
from ultimate consumers 95
commercial and industrial 95
large light and power 95
small light and power 95
electric railways 95
electrified railroads 95
municipal and miscellaneous 95
municipal street lighting 95
residential 95
rural 95

Station economics 90, 91
output, capacity and average use, by type of prime mover 91
output from fuel and fuel consumption . . 90

Electrical Manufacturing Industry

Page

Electrical goods orders 106

Industry and related factors 107
E. M. I. employment 107
E. M. I. production 107
electric power sales 107
F. R. B. production 107
population 107

Machinery indices 106
inventories, orders and shipments.

Manufacturers' sales 107
appliances 107
electrical material 107
generation apparatus 107
industrial apparatus 107
insulated wire and cable 107
refrigeration 107
transmission and distribution equipment . 107

Page

REA 108

Editor's Note—In certain instances data presented in this issue are somewhat different from figures in issues of previous years. These differences are caused by the fact that the flow of industry statistics is now in transition to practices conforming to the Uniform System of Accounts prescribed by the Federal Power Commission. So far as is possible, the editors have endeavored to maintain continuity of data in this issue, anticipating that in the 1942 Statistical Number it will be possible to present the whole picture on the basis of FPC accounting methods.

HIGHLIGHTS

OUTPUT: 144,600,000,000 Kw.-Hr.

Two-thirds of total from industrial areas. Gained 12 per cent over 1939; output from fuel up 14 per cent, hydro 7; East South Central led regionally.

CAPACITY: 41,661,000 Kw.

Net gain of 1,343,000 kw. in year, with steam accounting for 1,000,000. Steam makes up 70 per cent of total, hydro 28 and internal combustion 2.

NEW CAPACITY: 1,852,000 Kw.

Nearly 4,000,000 kw. scheduled for 1941, 15 per cent more than in any previous year. New 1940 and scheduled capacity totals 9.5 million kw.

ENERGY SALES: 118,487,000,000 Kw.-Hr.

Increase of 13 billion record for any one year. Two-thirds of growth in industrial usage, accounting for half of total. Residential up 12 per cent.

REVENUE: $2,413,000,000

Record revenue in year, but increase less than half percentage-wise of sales gain. Street lighting up three-quarter million. Residential rate below 4 cents for first time.

CUSTOMERS: 30,091,000

Nearly one million more customers, with 90 per cent in residential group. Rural classification showed 8 per cent gain, or nearly 52,000 consumers.

OPERATING EXPENSES: $850,000,000

Operations up 48 millions. Taxes rose 65 millions, almost twice amount in any previous year. Operating ratio, before taxes, steady at 37.5.

FINANCING: $989,500,000

Total about same as in 1939, with less than 10 per cent for new capital. Twenty-eight issues placed privately, totaling $189,000,000.

BUDGET: $724,110,000

Largest since 1930, 21 per cent ahead of 1940. Generating capacity gets 42 per cent, transmission, distribution and substations 53 per cent.

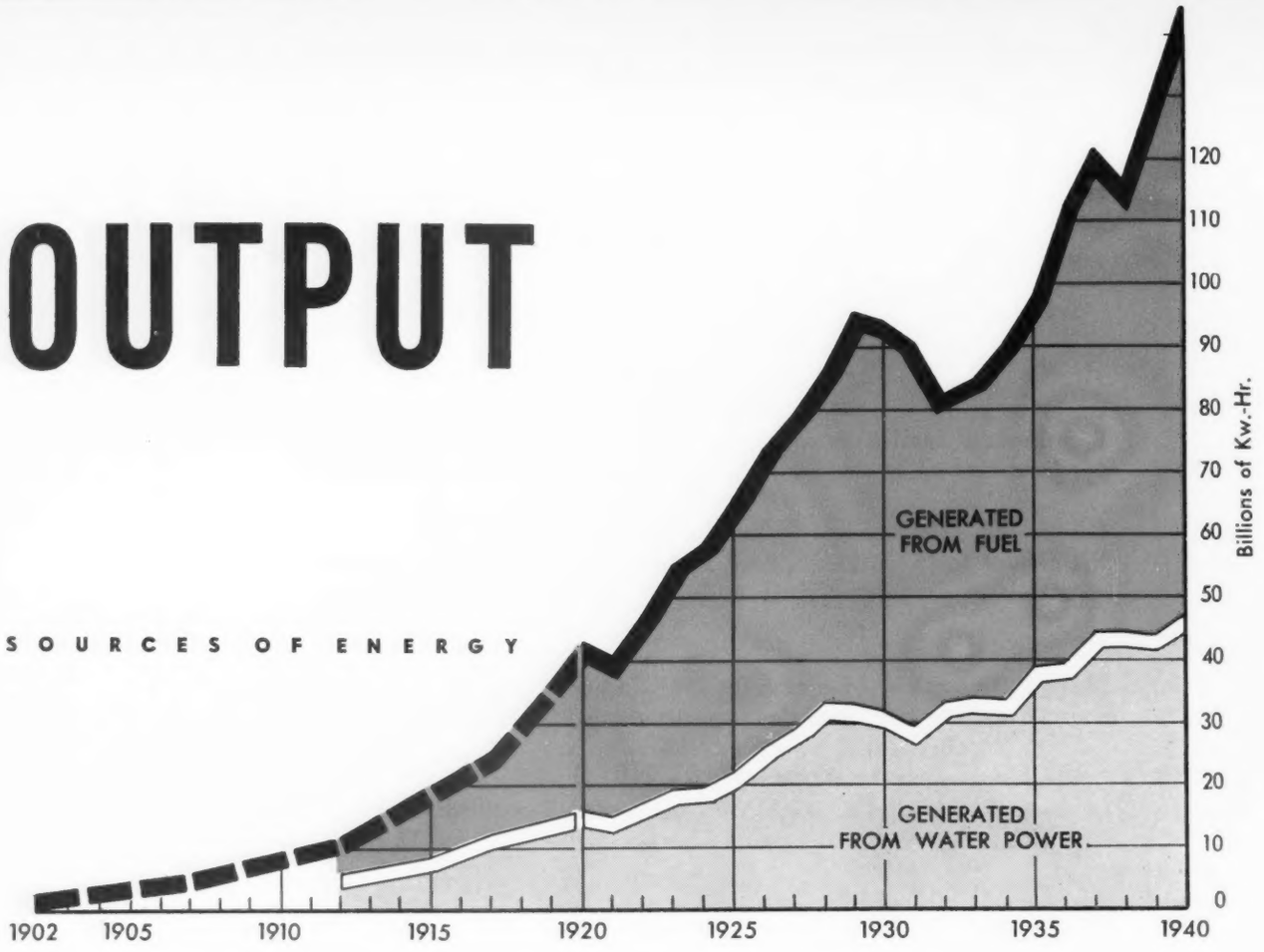
MANUFACTURING: $1,800,000,000

Sales of apparatus, supplies and appliances up 25 per cent over 1939, just under 1929 peak. New year opens with record backlog.

REA: 568,000 Consumers

Operating systems number 630, averaging 370 miles of line per system, 2.43 consumers per mile of line, $472 of funds advanced per consumer.

OUTPUT



TOTAL ENERGY generated in 1940 was 144.6 billion kw.-hr., an increase of 11.5 per cent.

It is now taking fourteen years for the output to double, last year's production being approximately twice that of 1926. It took eight years to double in the period 1920-1928, while from 1902-1917 output doubled every five years.

Despite heavy federal hydro expenditures, water power is steadily cutting a smaller figure; output from hydro has

SOURCE AND DISPOSAL OF ENERGY (Millions of Kw.-Hr.)

Year	Generated by			Total Generation	Add Imports from Canada	Less Energy Used by Producer	Total for Distribution	Losses	Sales to Ultimate Customers
	Steam	Water Power	Internal Combustion						
1927....	49,997	29,029	339	79,365	1,166	6,620	73,911	12,659	61,251
1928....	52,609	33,389	560	86,558	1,151	6,879	80,830	13,842	66,988
1929....	62,160	33,191	574	95,925	962	6,610	90,277	14,983	75,294
1930....	62,278	31,738	636	94,652	1,084	6,269	89,467	14,561	74,906
1931....	60,505	29,580	644	90,729	794	5,459	86,064	14,162	71,902
1932....	48,457	33,322	598	82,377	446	5,248	77,575	13,864	63,711
1933....	50,094	34,058	584	84,736	613	4,910	80,439	14,523	65,916
1934....	56,451	33,713	642	90,806	893	5,499	86,200	15,118	71,082
1935....	58,650	39,034	780	98,464	901	5,669	93,696	16,100	77,596
1936....	71,756	39,516	909	112,181	1,054	5,826	107,409	17,365	90,044
1937....	76,330	44,489	1,018	121,837	1,216	5,653	117,400	18,041	99,359
1938....	70,727	44,834	1,120	116,681	1,132	5,921	111,892	18,161	93,731
1939....	85,007	44,022	1,307	130,336	1,250	6,712	124,874	19,107	105,768
1940*...	97,300	47,300	†	144,600	1,000	7,000	138,600	20,113	118,487

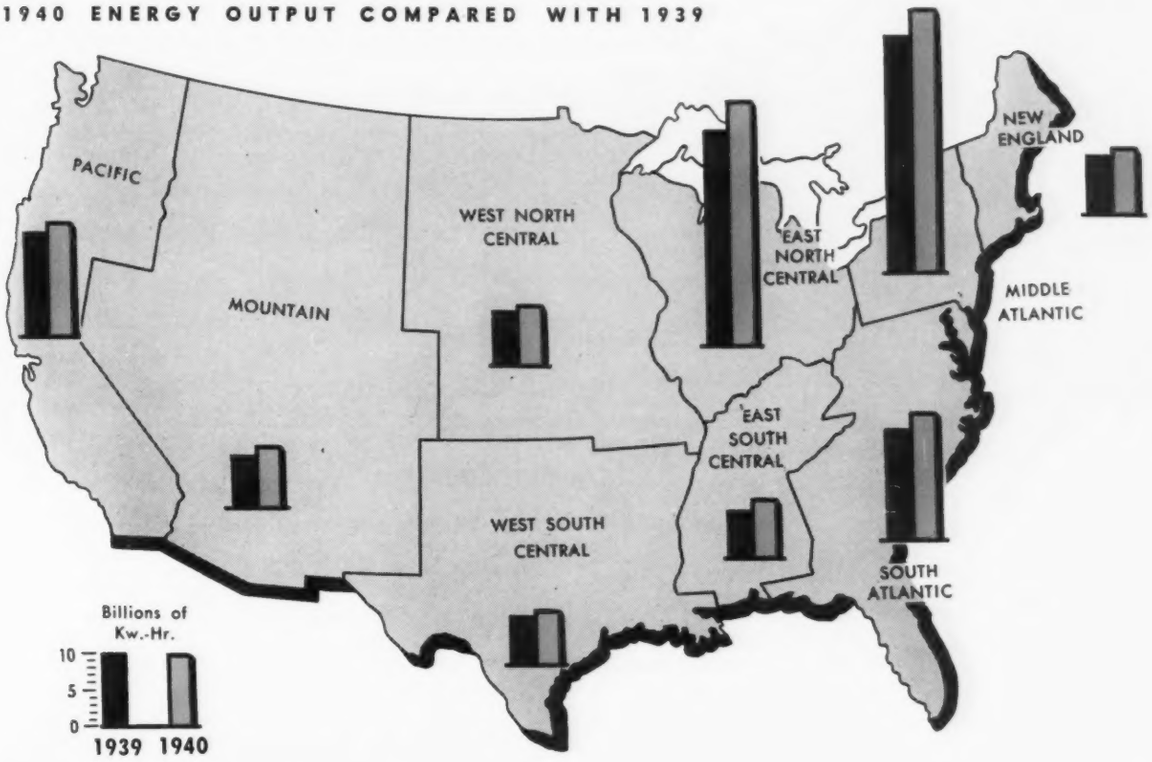
Sources: Federal Power Commission and Edison Electric Institute. * Estimated. † See steam.

increased 81.5 per cent since 1926, while fuel generation has increased 106.5 per cent. Last year generation from fuel was up 14 per cent and hydro but 7 per cent.

Energy used by the producer shows little change in thirteen years, remaining around 7 billion kw.-hr.

System losses, on the other hand, shows a steady improvement in efficiency. Taking the period of fourteen years during which output doubled, efficiency improved from 83 to 85.5 per cent. The additional kilowatt-hours available for sale at the average price represent 50 millions more revenue.

1940 ENERGY OUTPUT COMPARED WITH 1939



ENERGY GENERATED

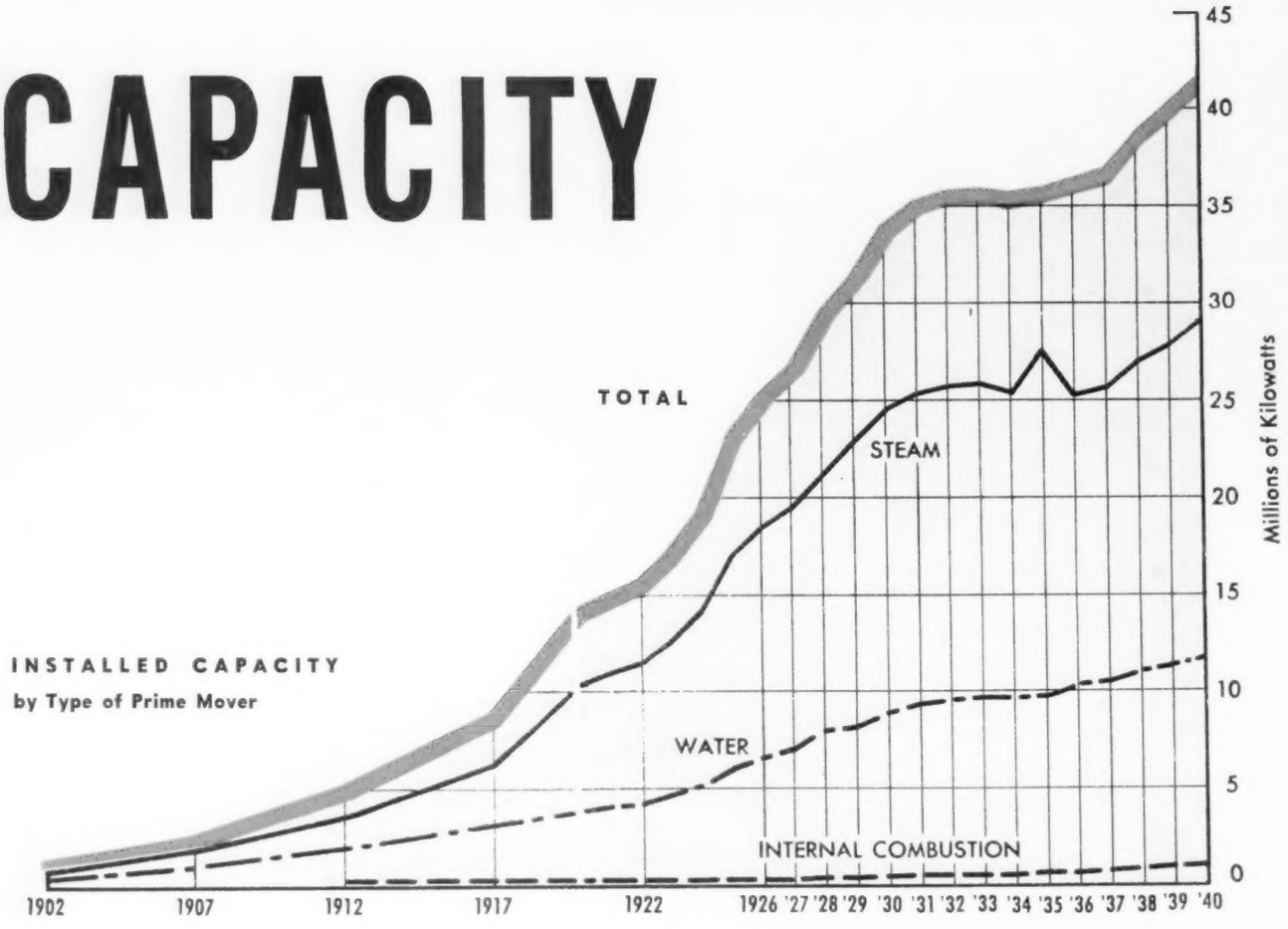
All Public Utility Power Plants
(Millions of Kw.-Hr.)

Region	1937	1938	1939	1940*
N.E.	7,842	7,366	8,350	9,030
M.A.	31,345	29,938	32,970	36,330
E.N.C.	28,696	26,416	29,995	33,210
W.N.C.	7,771	7,552	7,860	8,430
S.A.	14,133	13,177	15,190	17,360
E.S.C.	5,137	5,780	6,968	8,440
W.S.C.	6,376	6,394	6,980	7,390
Mountain	5,778	5,977	7,493	8,710
Pacific	14,759	14,081	14,531	15,700
U.S.	121,837	116,681	130,336	144,600

Source: Federal Power Commission. *Estimated.

While the industrial areas of New England, Middle and South Atlantic and East North Central states contributed two-thirds of the total output, the effect of the spreading of some of the defense business in other areas was noticeable. The East South Central, with emphasis on Tennessee and Alabama, while less than 6 per cent of the total, showed the greatest gain (21.1 per cent). The Mountain states area was next, with 16.3 per cent.

CAPACITY



GENERATING CAPACITY at the end of 1940 stood at 41,661,000 kw., a net gain of 1,343,000 kw.

New capacity added during the year, as shown on succeeding pages, was much greater. Retirements, however, reduced the net gain to the figure shown.

Steam (29,009,000 kw.) constitutes 70 per cent of the total, hydro (11,726,000 kw.) is 28 per cent, and internal combustion engines (926,000 kw.) 2 per cent.

One million kilowatts was the net increase made in steam capacity during 1940. Less than a third as much (310,000 kw.) was the net increase in hydro capacity.

In the fourteen years that it took to double output (1926-1940) the total generating capacity has grown 64 per cent. This growth was divided 41 steam, 20 hydro, 3 internal combustion.

After a relatively slow growth since 1931 the curve once more is turning sharply upward. The 3.3 per cent rise for 1940 is 60 per cent greater than the average during the entire 30's.

INSTALLED CAPACITY BY REGIONS AND BY TYPE OF PRIME MOVER

All Public Utility Power Plants (Thousands of Kilowatts)

Region	1938				1939				1940*			
	Steam	Hydro	Int. Comb.	Total	Steam	Hydro	Int. Comb.	Total	Steam	Hydro	Int. Comb.	Total
N.E.	2,097	843	13	2,953	2,164	852	13	3,029	2,180	879	14	3,073
M.A.	7,985	1,570	34	9,589	8,141	1,571	34	9,746	8,240	1,597	35	9,872
E.N.C.	7,972	709	61	8,742	8,279	710	81	9,070	8,640	711	110	9,461
W.N.C.	2,244	532	267	3,043	2,327	532	299	3,158	2,470	540	318	3,328
S.A.	2,582	1,986	70	4,638	2,709	2,061	73	4,843	2,970	2,143	75	5,188
E.S.C.	760	1,164	26	1,950	755	1,221	25	2,001	750	1,366	24	2,140
W.S.C.	1,622	139	165	1,926	1,722	139	180	2,041	1,750	236	197	2,183
Mountain	483	1,382	85	1,950	482	1,581	94	2,157	500	1,607	96	2,203
Pacific	1,458	2,741	52	4,251	1,468	2,748	57	4,273	1,509	2,647	57	4,213
U.S.	27,203	11,066	773	39,042	28,047	11,415	856	40,318	29,009	11,726	926	41,661

Source: Federal Power Commission. * Estimated.

Government projects have contributed the bulk of the fourteen-year increase of 50 per cent in hydro facilities. The 76 per cent growth in steam capacity has been very largely privately owned.

Growth in internal combustion capacity, now 4.8 times what it was fourteen years ago, to a large degree reflects the increased activity of the past six years in public ownership.

The distribution regionally between steam and hydro remains the same, with the East largely steam and the West hydro. In the Pacific states, however, steam appears to be growing at the expense of hydro.

The Southern states showed the greatest relative capacity increases in 1940.

It was the heavy industrial area of the East North Central which turned in the largest net increase—almost 400,000 kw. At the rate this section is growing it should surpass the Middle Atlantic states in another year or two and regain its No. 1 position for total power capacity.

The South Atlantic, with its 340,000 kw. net gain, was a close second. Because of retirements of hydro the Pacific states, in spite of all the new capacity added during the year, showed a net reduction in generating facilities for the year.

GENERATING FACILITIES

By Type of Prime Mover (Kw.)
All Public Utility Power Plants

Year	Steam	Hydro	Internal Combustion	Total
1927	19,683,534	7,134,143	203,238	27,020,915
1928	21,335,347	8,060,771	317,899	29,714,017
1929	23,129,693	8,166,479	326,419	31,622,591
1930	24,695,862	8,941,020	418,437	34,055,319
1931	25,474,380	9,444,771	450,513	35,369,664
1932	25,921,209	9,583,009	487,099	35,991,317
1933	26,008,665	9,736,063	498,188	36,242,916
1934	25,524,206	9,741,739	525,127	35,791,072
1935	25,708,209	9,795,138	571,095	36,074,442
1936	25,519,062	10,436,493	608,887	36,564,442
1937	25,872,720	10,576,614	685,048	37,134,382
1938	27,202,844	11,066,063	773,198	39,042,105
1939	28,046,948	11,415,165	855,811	40,317,924
1940*	29,009,000	11,726,000	926,000	41,661,000

Source: Federal Power Commission. * Estimated.

GENERATOR RATING—Public Utility Power Plants

Central Stations, Municipal, Railway and Other

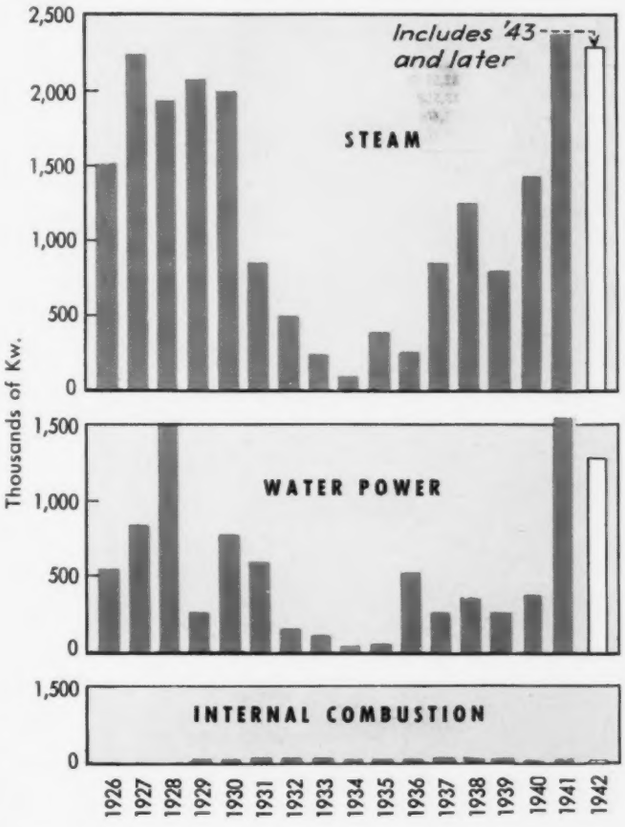
Preliminary as of October 1, 1940 — Source: Federal Power Commission

Division and State	No. of Companies *	No. of Plants	Total Capacity Kw.	Generator Capacity in Kilowatts of Plants Operated by										
				One Type of Prime Mover						Combination of Two or More Types				
				Water Power		Steam Power		Internal Comb. Engines		Total		Water Power	Steam Power	Int. Comb. Engines
				Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity	Capacity	Capacity	Capacity
United States	1,782	3,910	41,000,079	1,419	11,336,405	1,140	27,981,016	1,122	779,684	229	902,974	219,416	545,298	138,260
New England	145	332	3,060,799	230	859,583	68	2,075,025	11	9,739	23	116,452	17,708	95,415	3,329
Maine	25	78	288,272	62	214,731	7	69,650	5	1,261	4	2,630	1,190	800	640
New Hampshire	15	56	317,684	46	234,104	4	61,500	1	765	5	21,315	1,715	19,225	375
Vermont	25	71	178,839	62	165,992	3	9,400	0	0	6	3,447	1,297	1,950	200
Massachusetts	55	79	1,361,633	34	151,746	35	1,131,735	3	6,392	7	71,760	12,706	56,940	2,114
Rhode Island	6	11	238,321	5	3,350	5	234,750	1	221	0	0	0	0	0
Connecticut	19	37	676,050	21	89,660	14	567,990	1	1,100	1	17,300	800	16,500	0
Middle Atlantic	139	397	9,678,127	217	1,450,707	140	8,037,864	24	30,552	16	159,004	116,931	37,650	4,423
New York	70	245	5,503,985	179	1,162,637	48	4,313,475	9	19,224	9	8,649	3,196	1,850	3,603
New Jersey	15	25	1,129,287	4	6,700	15	1,112,450	4	2,617	2	7,520	400	7,000	120
Pennsylvania	54	127	3,044,855	34	281,370	77	2,611,939	11	8,711	5	142,835	113,335	28,800	700
East North Cent.	327	660	9,319,871	271	694,121	266	8,352,484	83	72,251	40	201,015	15,362	155,279	30,374
Ohio	73	108	2,431,404	7	11,925	84	2,406,796	16	10,083	1	2,600	600	2,000	0
Indiana	58	92	1,293,466	21	35,494	54	1,230,330	16	15,642	1	12,000	0	1,300	10,700
Illinois	66	95	2,615,869	10	46,627	61	2,444,478	18	14,996	6	109,768	3,913	102,445	3,410
Michigan	64	186	1,992,380	120	339,727	34	1,609,225	18	19,826	14	23,602	4,151	7,459	11,992
Wisconsin	66	179	986,752	113	260,348	33	661,655	15	11,704	18	53,045	6,698	42,075	4,272
West North Cent.	472	819	3,263,690	118	528,855	212	2,327,859	432	272,517	57	134,459	10,497	83,673	40,289
Minnesota	74	141	686,681	41	154,951	45	490,270	39	21,169	16	20,291	2,328	7,032	10,931
Iowa	100	174	706,505	27	123,095	47	446,137	87	64,749	13	72,524	3,669	60,696	8,159
Missouri	67	106	814,246	7	158,345	33	605,678	62	47,765	4	2,458	0	938	1,520
North Dakota	17	38	89,617	0	0	16	81,340	21	7,053	1	1,224	0	500	724
South Dakota	37	62	87,370	6	4,260	8	48,850	44	23,951	4	10,309	0	4,592	5,717
Nebraska	92	161	361,920	30	82,018	30	220,944	87	42,217	14	16,741	3,840	2,745	10,156
Kansas	85	137	517,351	7	6,186	33	434,640	92	65,613	5	10,912	660	7,170	3,082
South Atlantic	170	410	5,076,352	151	2,097,791	132	2,733,683	106	67,657	21	177,221	38,943	129,727	8,551
Delaware	7	8	37,475	0	0	4	33,200	4	4,275	0	0	0	0	0
Maryland	13	28	683,917	3	271,385	12	404,025	11	5,637	2	2,870	0	770	2,100
Dist. of Columbia	2	3	257,400	1	2,400	2	255,000	0	0	0	0	0	0	0
Virginia	29	70	614,970	34	168,620	16	306,960	14	8,310	6	131,080	15,144	113,750	2,186
West Virginia	16	39	733,348	10	100,880	18	627,410	9	4,737	2	321	100	0	221
North Carolina	35	84	1,197,215	50	708,043	23	480,075	9	7,799	2	1,298	649	0	649
South Carolina	17	41	656,478	24	503,228	8	132,430	7	3,230	2	17,590	12,300	5,200	90
Georgia	17	56	482,639	26	329,042	22	135,701	4	1,124	4	16,772	10,550	5,312	910
Florida	34	81	412,910	3	14,193	27	358,882	48	32,545	3	7,290	200	4,695	2,395
East South Cent.	79	196	2,148,670	38	1,366,752	84	753,117	67	24,421	7	4,380	225	2,835	1,320
Kentucky	19	41	371,048	3	110,860	27	256,080	8	2,878	3	1,230	225	615	390
Tennessee	23	55	710,800	22	512,459	20	193,760	11	2,871	2	1,710	0	1,420	290
Alabama	13	42	1,003,307	13	743,433	17	254,230	11	4,904	1	740	0	500	240
Mississippi	24	58	63,515	0	0	20	49,047	37	13,768	1	700	0	300	400
West South Cent.	182	428	2,103,475	29	152,273	103	1,725,736	283	185,778	13	39,688	654	26,107	12,927
Arkansas	25	52	158,183	5	67,008	18	73,488	28	17,042	1	645	0	250	395
Louisiana	38	67	416,035	0	0	10	373,870	56	40,415	1	1,750	0	850	900
Oklahoma	57	101	366,131	2	1,200	24	314,998	70	45,522	5	4,411	424	957	3,030
Texas	62	208	1,163,126	22	84,065	51	963,380	129	82,799	6	32,882	230	24,050	8,602
Mountain	172	367	2,185,824	155	1,572,845	75	491,878	95	65,002	42	56,099	11,276	13,232	31,591
Montana	12	31	335,844	18	321,185	4	10,265	6	1,762	3	2,632	180	1,506	946
Idaho	18	49	261,140	37	254,781	3	850	4	1,729	5	3,780	2,620	0	1,160
Wyoming	28	43	87,666	10	47,770	18	33,529	10	3,687	5	2,680	1,680	300	700
Colorado	39	80	287,959	22	64,682	29	210,029	21	10,058	8	3,190	1,438	575	1,177
New Mexico	19	39	111,645	1	80	11	90,745	24	15,824	3	4,996	788	1,134	3,074
Arizona	23	47	431,396	12	293,075	8	86,710	21	26,226	6	25,385	40	7,217	18,128
Utah	25	65	161,047	48	87,922	2	59,750	6	3,595	9	9,780	3,990	0	5,790
Nevada	8	13	509,127	7	503,350	0	0	3	2,121	3	3,656	540	2,500	616
Pacific	96	301	4,163,271	210	2,613,478	60	1,483,370	21	51,767	10	14,656	7,820	1,380	5,456
Washington	31	68	1,020,009	48	797,671	13	217,420	4	1,202	3	3,716	2,140	1,080	496
Oregon	30	75	462,129	47	276,492	19	178,200	5	1,067	4	6,370	2,030	300	4,040
California	35	158	2,681,133	115	1,539,315	28	1,087,750	12	49,498	3	4,570	3,650	0	920

* Total includes 89 duplications because of companies operating in more than one state. Includes data from rural electrification projects operating electric generating plants.

NEW CAPACITY

NEW GENERATING CAPACITY



LAST YEAR 1,851,848 kw. of new generating capacity was placed in service. In 1941 the total scheduled is 3,967,394 kw. In 1942 the schedule calls for 2,338,430, and beyond that date already scheduled is 1,261,700—a grand total of 9,419,372 kw.

Additional 1942 capacity orders are expected to make the three years 1940-1942 the heaviest period of additions to capacity in the history of the industry. The year 1941, for instance, is scheduled to add more kilowatts than any previous twelve months by approximately 15 per cent.

For 1940 private additions to capacity to meet the defense load were nearly three times public additions. Of the total 9.5 million kw. now known to be definitely scheduled, slightly over 60 per cent, represents additions to privately owned systems.

Steam capacity scheduled to be added is nearly twice hydro in spite of the fact that in 1941 large increments of federal power on the Columbia River and elsewhere, started some years before the war, are scheduled to come in this year. New steam capacity scheduled amounts to slightly more than 6 million kw., hydro to 3.3 million kw.

NEW CAPACITY ADDED EACH YEAR

as reported to Electrical World for the entire industry

Year	Kilowatts			Total
	Steam	Hydro	Int. Comb.	
1928	1,935,500	†1,520,000	(s)	3,455,500
1929	2,075,285	‡249,200	5,800	2,329,485
1930	2,034,527	748,480	6,420	2,789,437
1931	821,100	566,500	15,400	1,403,000
1932	457,750	126,155	8,550	592,455
1933	215,775	95,325	35,250	346,350
1934	47,000	41,900	5,805	94,705
1935	345,325	38,950	1,815	386,090
1936	211,900	‡489,865	19,328	721,093
1937	851,100	245,346	22,314	1,118,760
1938	1,327,239	345,605	23,064	1,695,908
1939	906,700	370,150	7,980	1,284,830
1940	1,427,250	397,984	26,614	1,851,848
1941§	2,381,300	1,545,700	40,394	3,967,394
1942§	1,765,750	561,300	11,380	2,338,430
1943*§	520,500	734,200	2,000	1,261,700

† Kw. estimated; reported wholly or partly in hp.
‡ Incl. Boulder 165,000, Norris 100,000. § Prospective.
* Includes 1944 and later.
s Included with steam.

GENERATING CAPACITY ADDED IN 1940

Steam

Private Companies	Kw.
American Gas & Electric (Central System)	54,000
Arkansas Power & Light	38,000
Brockton Edison	5,000
Central Arizona Light & Power	15,000
Central Illinois Public Service	25,000
Central Maine Power	12,500
Central Power & Light	7,500
Columbia Gas & Electric System	30,000
Commonwealth Edison & Subs	105,000
Consolidated Edison of N. Y. & Assoc.	40,000
Consolidated Gas Electric & Power of Baltimore	25,000
Consumers Power	35,000
Dakota Power	3,000
Dakota Public Service	4,000
Derby Gas & Electric	3,500
Detroit Edison	75,000
Duke Power	80,000
Florida Power & Light	30,000
Gulf Public Service	3,500
Holyoke Water Power	5,000
Iowa Electric Light & Power	15,000
Kansas Power & Light	15,000
Laclede Power & Light	20,000
Las Vegas Light & Power	1,500
Missouri Utilities	5,000
Montana-Dakota Utilities	5,000
New Mexico Power	1,500
New Mexico Public Utilities	1,000
Niagara Hudson Power System	80,000
Northern States Power (Minn.) & Subs	17,500
Ohio Edison	35,000
Pacific Gas & Electric	53,500
Pacific Power & Light	3,000
Panhandle Power & Light	23,000
Pennsylvania Power & Light	2,000
Potomac Electric Power	50,000
Public Service Electric & Gas	100,000
South Carolina Electric & Gas	16,000
Union Electric of Missouri & Subs	25,000
United Illuminating	12,500
United Light & Power System	63,000
Virginia Electric & Power	40,000
Virginia Public Service	15,000
Western Public Service	2,500
Total	1,198,000

Municipal and Other Public Plants	Kw.
Ames, Iowa	3,000
Austin, Minn.	5,000
Atlanta, Iowa	1,500
Coldwater, Mich.	2,500
Columbia, Mo.	12,000
Columbia City, Ind.	2,500
Crawfordsville, Ind.	5,000
Decatur, Ind.	5,000
Dyersburg, Tenn.	3,500
Glendale, Calif.	20,000
Grand Island, Neb.	5,000
Greenville, N. C.	5,000
Hibbing, Minn.	5,000
Holland, Mich.	15,000
Lamar, Colo.	2,000
Lansing, Mich.	31,500
McPherson, Kans.	5,000
Muscatine, Iowa	7,500
Norwich, Conn.	7,500
Orrville, Ohio	2,500
Ottawa, Kans.	4,000
Owensboro, Ken.	15,000
Piqua, Ohio	4,000
Rushville, Ind.	2,000
Springfield, Ill.	15,000
Valley City, N. D.	5,000
Washington, Ind.	6,000
Wilson, N. C.	8,250
Braintree, Mass.	7,500
Columbia, Ohio	10,000
Frankfort, Ind.	5,000
Hope, Ark.	1,500
Total	229,250

Hydro

Private Companies	
Arkansas Power & Light	65,968
Central Maine Power	24,000
Lake Superior District Power	2,000
Montana Power	250
Pacific Gas & Electric	4,870
Pennsylvania Water Power & Safe Harbor Water Power	30,000
Rumford Falls Power	2,250
Virginia Electric & Power	2,100
Wisconsin Power & Light	3,350
Total	134,788

Municipal and Other Public Plants	
Bureau of Reclamation (U.S.)	24,300
Cedar Falls, Iowa	1,200
Holyoke, Mass.	465
Kaukauna, Wis.	2,400
Los Angeles, Calif.	82,500
Lower Colorado River Authority	13,500
Tennessee Valley Authority	138,600
Wilson, N. C.	231
Total	263,196

Internal Combustion

Private Companies	
Arkansas Power & Light	2,770
Colorado Utilities	250
Gulf Public Service	2,750
Gulf States Utilities	300
Kansas Power	1,250
Key West Electric	700
Missouri Electric Power	800
Northwestern Public Service	1,000
Oklahoma Electric & Water	400
Otter Tail Power	225
Sioux City Gas & Elec.-Iowa Public Service System	731
Texas-New Mexico Utilities	500
West Coast Power	120
West Texas Utilities	350
Western Light & Telephone	344
Total	12,490

Municipal and Other Public Plants	Kw.
Bloomington, Ill.	500
Bryan, Ohio	2,250
Keystone Heights, Fla.	473
Lubbock, Tex.	1,795
Rochelle, Ill.	870
Rural Electrification Admins.	6,486
Sturgis, Mich.	1,750
Total	14,124

TOTALS FOR 1940

Kilowatts	Private Companies	Municipal and Federal	Total
Steam	1,198,000	229,250	1,427,250
Hydro	134,788	263,196	397,984
Int. Comb'n.	12,490	14,124	26,614
Total	1,345,278	506,570	1,851,848

Additions to capacity in 1940 were greater than in any year since 1930. They exceeded 1939 by 50 per cent. Steam took more than three-quarters of the total. Almost half of the hydro was for privately owned systems.

The largest additions were 105,000 kw. for Commonwealth Edison, 100,000 kw. for New Jersey Public Service and 80,000 kw. each for Duke Power and Niagara Hudson. Some 43 municipals added capacity in 1940 aggregating 323,684 kw. of which 75 per cent was in steam.

This year will be the record year for capacity additions, as well as for new steam plant. The list is widespread geographically and includes such large additions as 154,000 kw. for Commonwealth Edison; 130,000 kw., Consolidated Edison; 107,500 kw. American Gas & Electric (Central System); 100,000 kw. each Georgia Power and Pacific Gas & Electric; 95,000 kw., Columbia Gas & Electric; 85,000 kw., Consumers Power, and 80,000 kw. each for Duke Power, Niagara Hudson and Union Electric.

New capacity for succeeding years as far as is scheduled is shown on this and the next page. Almost every week brings additions to the list.

GENERATING CAPACITY TO BE ADDED IN 1941

Steam

Private Companies	*Kw.*
Alabama Power	40,000
American Gas & Electric (Central System)	107,500
Atlantic City Electric	25,000
Central Illinois Electric & Gas	2,500
Central Illinois Light	35,000
Central Illinois Public Service	25,000
Central Ohio Light & Power	7,500
Central States Power & Light	1,000
City Light & Traction	5,000
Cleveland Electric Illuminating	60,000
Commonwealth Edison & Subs	154,000
Community Public Service	7,500
Connecticut Power	25,000
Consolidated Edison of N. Y. & Assoc	130,000
Consolidated Gas Electric Light & Power of Baltimore	50,000
Consumers Power	85,000
Colorado Utilities	1,500
Columbia Gas & Electric System	95,000
Duke Power	80,000
Duquesne Light	60,000
Eastern Shore Public Service & Subs	7,500
Florida Power & Light	30,000
Georgia Power	100,000
Indianapolis Power & Light	37,500
Interstate Power	7,500
Jersey Central Power & Light	15,000
Long Island Lighting	50,000
Louisville Gas & Electric	25,000
Louisiana Public Utilities	1,500
Marion-Reserve Power	15,000
Metropolitan Edison	20,000
Missouri Power & Light	5,000
Missouri Utilities	800
Montaup Electric	25,000
Mountain States Power	2,500
New Bedford Gas & Edison Light	7,500
New England Power & Mass. Util. Assoc. & Subs.	40,000
Newport Electric	4,000
New York State Electric & Gas	20,000
Niagara Hudson Power System	80,000
Northern States Power (Minn.) & Subs	50,000
Ohio Public Service	37,500
Pacific Gas & Electric	100,000
Pennsylvania Power & Light	21,000
Philadelphia Electric System	50,000
Public Service of Colorado	25,000
Public Service Electric & Gas	50,000
Public Service of Indiana	50,000
Rochester Gas & Electric	15,000
Salt River Valley Water Users Assoc	22,500
Southwestern Public Service	5,000
Southern Colorado Power	7,500
Texas-New Mexico Utilities	7,500
Toledo Edison	50,000
Union Electric of Illinois	80,000
United Illuminating	25,000
United Light & Power System	15,000
Union Public Service	5,000
Virginia Electric & Power	40,000
West Coast Power	2,500
Western Pennsylvania Group (Central U.S. Utilities)	15,000
Wisconsin Electric Power	35,000
Wisconsin Power & Light	30,000
Total	2,228,800

Municipal and Other Public Plants	
Burbank, Calif.	10,000
Bureau of Reclamation (U.S.)	28,000
Cleveland, Ohio	37,500
Eugene, Ore.	7,500
Fort Wayne, Ind.	15,000
Hagerstown, Md.	4,000
Holyoke, Mass.	1,000
Jasper, Ind.	3,000
Manitowoc, Wis.	10,000
Marshall, Mo.	2,500
Marshfield, Wis.	3,500
Martins Ferry, Ohio	3,000
Rural Electrification Administration	6,000
Stillwater, Okla.	4,000
Taunton, Mass.	5,000
Wilson, N. C.	7,500
Woodstock, Ill.	5,000
Total	152,500

Hydro

Private Companies	
Cliffs Power & Light	2,000
Maine Public Service	700
Niagara Hudson Power System	3,000
Puget Sound Power & Light	12,500
Tucson Gas, Elec. Light & Power	15,000
Total	33,200

Municipal and Other Public Plants	
Bonneville, Oregon	432,000
Bureau of Reclamation	571,000
Central Nebraska Public Power & Irrig. Dist.	54,000
High Point, N. C.	21,000
Los Angeles, Calif.	165,000
Lower Colorado River Authority	67,500
South Carolina Public Service Auth.	112,000
Tennessee Valley Authority	90,000
Total	1,512,500

Internal Combustion

Private Companies	
Arizona Edison	2,000
Community Public Service	750
Gulf Public Service	1,250
Iowa Electric Light & Power	5,000
Oklahoma Gas & Electric	765
Sac County Electric	360
Sierra Pacific	90
Sioux City Gas & Electric & Iowa Public Service System	2,500
Tipton Light & Water	1,000
United Light & Power System	1,250
West Coast Power	360
Western Public Service	1,230
Total	16,555

Municipal and Other Public Plants	
Denton, Texas	700
Freeport, N. Y.	2,000
Keystone Heights, Fla.	473
Lubbock, Texas	1,795
Rural Electrification Administration	18,871
Total	23,839

TOTALS FOR 1941

Kilowatts	Private Companies	Municipal and Federal	Total
Steam	2,228,800	152,500	2,381,300
Hydro	33,200	1,512,500	1,545,700
Int. Comb'n.	16,555	23,839	40,394
Total	2,278,555	1,688,839	3,967,394

GENERATING CAPACITY TO BE ADDED IN 1942—PROSPECTIVE

Steam

Private Companies	Kw.
American Gas & Electric (Central System)	85,000
American Water Works & Electric	65,000
Arkansas Utilities	3,500
Atlantic City Electric	20,000
Boston Edison	58,000
Central Maine Power	20,000
Central Power & Light	15,000
Cleveland Electric Illuminating	60,000
Commonwealth Edison & Subs	147,000
Connecticut Light & Power	43,750
Consolidated Edison Co. of N. Y. (Assoc.)	50,000
Consolidated Gas Electric & Power Co. of Baltimore	50,000
Detroit Edison	75,000
Duke Power	40,000
Duquesne Light	60,000
East Tennessee Light & Power	1,500
Florida Power	25,000
Hartford Electric Light	40,000
Jersey Central Power & Light	15,000
Kansas Electric Power	7,500
Louisiana Power & Light	35,000
Mt. Carmel Public Utility & Service	2,500
Niagara Hudson Power System	80,000
Pennsylvania Power & Light	30,000
Philadelphia Electric System	80,000
Potomac Edison & Subs	5,000
Potomac Electric Power	50,000
Public Service Electric & Gas	100,000
Southwestern Public Service	12,500
Staten Island Edison	15,000
Union Electric Co. of Illinois	80,000
United Light & Power System	45,000
Virginia Public Service	15,000
Western Pennsylvania Group (Central U.S. Utilities)	20,000
Wisconsin Public Service Corp. & Subs	25,000
Total	1,476,250

Municipal and Other Public Plants	
Burbank, Calif.	10,000
Colorado Springs, Colo.	7,500
Columbia, Mo.	7,500
Dover, Ohio	2,500
Fort Pierce, Fla.	5,000
Fremont, Nebr.	5,000
Gainesville, Fla.	5,000
Kansas City, Kans.	30,000
Lansdale, Pa.	5,000
Los Angeles, Calif.	65,000
Norwalk, Ohio	2,500
Richmond, Ind.	15,000
Tennessee Valley Authority	120,000
Valley City, N. D.	3,000
Vineland, N. J.	4,000
Washington, N. C.	3,500
Total	289,500

Hydro

Private Companies	
Bangor Hydro-Electric	2,500
Central States Power & Light	300
Northern States Power (Minn.) & Subs	10,000
Pacific Gas & Electric	20,400
Rockland Light & Power	10,000
Southern California Edison	82,500
Total	125,700

Municipal and Other Public Plants	
Bonneville	108,000
Tennessee Valley Authority	327,600
Total	435,600

Internal Combustion

Private Companies	
Arizona Edison	5,000
Gulf Public Service	1,250
Oklahoma Electric & Water	400
Sac County Electric	1,000
Western Public Service	1,230
Total	8,880

Municipal and Other Plants	
Hudson, Mass.	2,500

TOTALS FOR 1942 (PROSPECTIVE)

Kilowatts to Be Added	Private Companies	Municipal and Federal	Total
Steam	1,476,250	289,500	1,765,750
Hydro	125,700	435,600	561,300
Int. Comb.	8,880	2,500	11,380
Total	1,610,830	727,600	2,338,430

GENERATING CAPACITY TO BE ADDED IN 1943 OR LATER—PROSPECTIVE

Steam

Private Companies	Kw.
American Gas & Electric (Central System)	85,000
Central Illinois Electric & Gas	15,000
Florida Public Service—1944	12,500
Interstate Power	10,000
Kentucky Utilities	25,000
Long Island Lighting	50,000
Mississippi Valley Public Service—1945	10,000
New York State Electric & Gas	30,000
Northern States Power (Minn.) & Subs	50,000
Pennsylvania Edison	30,000
Potomac Edison—1944	30,000
San Diego Gas & Electric	35,000
Sheridan County Electric—1945	4,000
Wisconsin Electric Power	80,000
Total	466,500

Municipal and Other Public Plants	
Chanute, Kans.	5,000
Fort Wayne, Ind.	15,000
Glendale, Calif.	20,000
McPherson, Kans.—1945	7,500
Sanitary District, Chicago, Ill.—1948	5,000
Troy, Ohio	6,000
Winnetka, Ill.	500
Total	59,000

Hydro

Private Companies	Kw.
Maine Public Service—1945	1,200

Municipal and Other Public Plants	
Bureau of Reclamation	733,000

Internal Combustion

Private Companies	
Southwestern Public Service—1944	1,000

Municipal and Other Public Plants	
Rochelle, Ill.—1944	1,000

TOTALS FOR 1943 OR LATER (PROSPECTIVE)

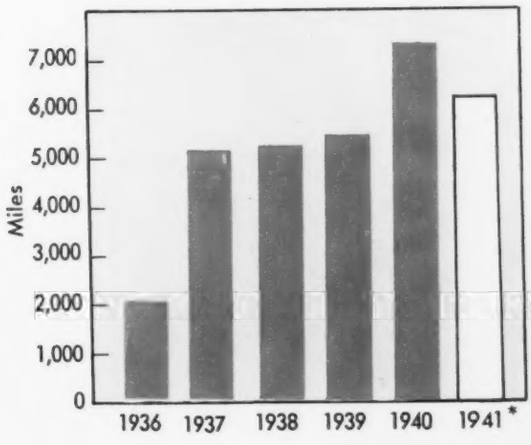
Kilowatts to be Added	Private Companies	Municipal and Federal	Total
Steam	466,500	59,000	525,500
Hydro	1,200	733,000	734,200
Int. Comb.	1,000	1,000	2,000
Totals	468,700	793,000	1,261,700

TRANSMISSION AND SUB-STATIONS

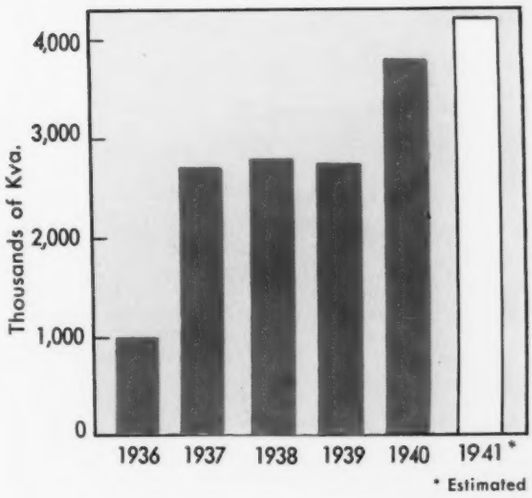
MORE THAN 7,000 miles of transmission lines of 11 kv. and over were built in 1940—a record for several years. A thousand less miles are scheduled for 1941, although the dollar budget for transmission construction is considerably higher. Most of the decrease occurs in the East North Central, which has been building lines heavily.

New substation capacity was 3.75 million kw. in 1940 and will be still greater in 1941.

NEW TRANSMISSION LINES



NEW SUBSTATION CAPACITY



* Estimated

CONSTRUCTION OF TRANSMISSION LINES

(Miles—11 Kv. and Up)

Region	1937	1938	1939	1940	1941 (Est.)
New England	127	99	169	154	202
Middle Atlantic	279	361	680	568	632
East North Central	785	882	940	1,290	603
West North Central	553	295	340	543	478
South Atlantic	798	617	740	1,125	1,060
East South Central	428	810	535	544	357
West South Central	615	674	720	879	1,195
Mountain	750	305	840	765	670
Pacific	802	1,113	415	1,430	1,160
United States	5,137	5,156	5,379	7,298	6,245

CONSTRUCTION OF SUBSTATIONS

(Thous. Kva.)

Region	1937	1938	1939	1940	1941 (Est.)
New England	146	123	225	368	259
Middle Atlantic	511	347	269	667	694
East North Central	597	649	612	1,042	869
West North Central	322	199	280	292	730
South Atlantic	440	368	385	398	429
East South Central	88	430	387	235	222
West South Central	191	105	60	157	259
Mountain	124	106	77	125	227
Pacific	193	422	323	495	510
United States	2,612	2,749	2,618	3,779	4,230

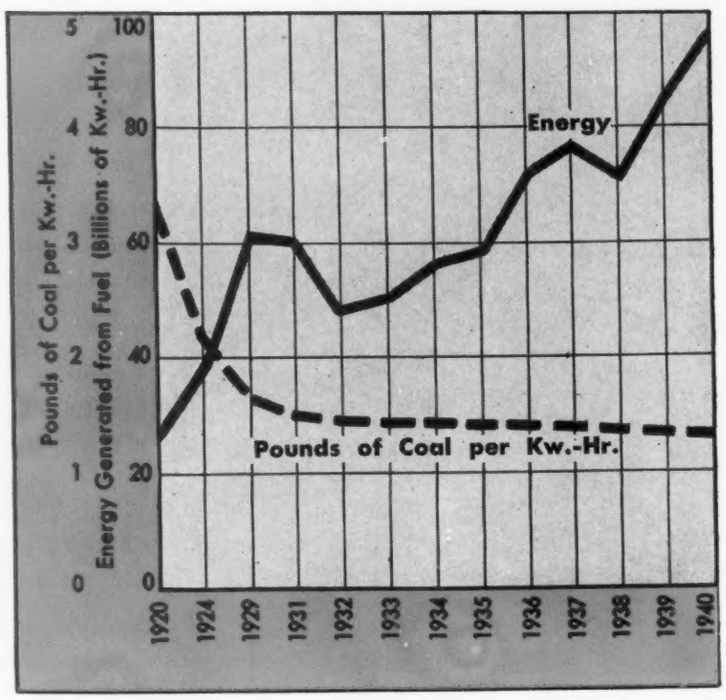
Source: "Electrical World" Surveys.

STATION ECONOMICS

GENERATING CAPACITY worked longer hours in 1940, reflecting double shifts and overtime work in factories.

For the first time the average hours use of fuel capacity exceeded 3,000 hours per year. With an improvement in hydro usage, due to improved water conditions, the national use was a new all-time high of 3,471 hours.

OUTPUT FROM FUEL AND FUEL CONSUMPTION



OUTPUT FROM FUEL AND FUEL CONSUMPTION

All public utility plants — Central stations, electric railway, electrified railroad, public works and other plants generating energy for public use
These statistics relate to all plants (not exclusively to central stations) having an output of 10,000 kw.-hr. per month, comprised in the totals reported each month, formerly by the U. S. Geological Survey, since July, 1936, by the F. P. C.

Year	Energy Generated from Fuel† (Millions of Kw.-Hr.)	Fuel Consumed				Pounds of Coal per Kw.-Hr.†
		Coal (Millions of Tons)	Oil (Millions of Bbl.)	Gas (Billions of Cu. Ft.)	Coal Equiv. (Millions of Tons)	
1920	27,228	42.94	10.47	21.86	46.15	3.39
1924	38,806	37.56	16.64	48.47	42.69	2.20
1929	62,295	44.93	10.19	112.62	52.64	1.69
1931	60,791	38.71	8.13	139.27	47.11	1.55
1932	48,931	30.30	7.97	107.84	36.70	1.50
1933	50,546	30.58	9.95	102.73	37.15	1.47
1934	56,914	33.56	10.39	127.89	41.83	1.47
1935	59,176	34.16	11.38	125.24	43.20	1.46
1936	72,188	42.03	14.12	156.08	51.99	1.44
1937	76,883	44.77	14.14	171.27	55.14	1.43
1938	71,525	40.21	13.08	170.69	50.56	1.41
1939	85,800	46.22	17.42	191.13	59.51	1.39
1940*	96,740	52.78	16.79	184.35	65.60	1.36

* Twelve months ended October 31. † Output by use of wood not included.

Increased steam-generated output resulted in the consumption of 6½ million tons more of coal, an increase of 14 per cent. Oil and gas consumption were particularly high in 1939, due largely to standby use during low water, but the fall-off in 1940 was not great.

Although more tonnage of coal was used, the fuel consumption dropped 2.6 per cent to 1.36 lb. of coal per kw.-hr. This is an improvement of 20 per cent over 1929.

OUTPUT, CAPACITY, AVERAGE USE (by Type of Prime Mover)

Source: Federal Power Commission. (All Public Utility Plants)

Year	Energy Generated (Millions of Kw.-Hr.)			Generating Capacity at End of Year (Thousand Kw.)			Output per Kw. of Ave. Cap. (Kw.-Hr.)		
	Fuel	Hydro	Total	Fuel	Hydro	Total	Fuel	Hydro	Total
1927.....	50,336	29,029	79,365	19,887	7,134	27,021	2,531	4,069	2,937
1928.....	53,169	33,389	86,558	21,653	8,061	29,714	2,456	4,142	2,913
1929.....	62,734	33,191	95,925	23,456	8,166	31,622	2,675	4,065	3,033
1930.....	62,914	31,738	94,652	25,114	8,941	34,055	2,505	3,550	2,779
1931.....	61,149	29,580	90,729	25,925	9,445	35,370	2,359	3,132	2,565
1932.....	49,055	33,322	82,377	26,408	9,583	35,991	1,858	3,477	2,289
1933.....	50,678	34,058	84,736	26,507	9,736	36,243	1,912	3,498	2,338
1934.....	57,093	33,713	90,806	26,049	9,742	35,791	2,192	3,461	2,537
1935.....	59,430	39,034	98,464	26,279	9,795	36,074	2,262	3,985	2,730
1936.....	72,665	39,516	112,181	26,128	10,436	36,564	2,781	3,787	3,068
1937.....	77,348	44,489	121,837	26,558	10,577	37,135	2,912	4,206	3,281
1938.....	71,847	44,834	116,681	27,976	11,066	39,042	2,568	4,052	2,989
1939.....	86,314	44,022	130,336	28,903	11,415	40,318	2,986	3,857	3,233
1940*.....	97,300	47,300	144,600	29,930	11,726	41,661	3,251	4,034	3,471

* Estimated.

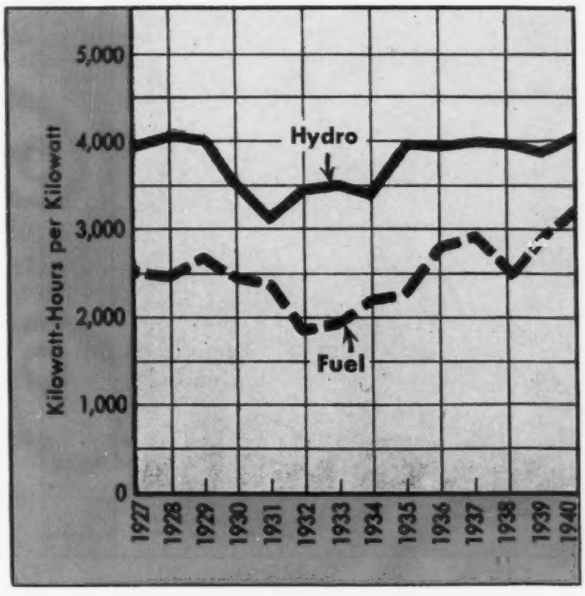
ENERGY GENERATED FROM FUELS AND WATER POWER

All Public Utility Power Plants
(By Regions, in Billions of Kilowatt-Hours)

Region	1937		1938		1939		1940*	
	Fuel†	Water Power	Fuel†	Water Power	Fuel†	Water Power	Fuel†	Water Power
New England.....	4.61	3.29	4.05	3.31	5.47	2.88	6.23	2.80
Middle Atlantic.....	22.65	8.32	21.64	8.29	25.63	7.34	28.71	7.62
East North Central.....	26.09	2.35	23.38	3.03	27.11	2.88	30.39	2.82
West North Central.....	5.82	1.99	5.45	2.10	5.99	1.87	6.78	1.65
South Atlantic.....	6.97	7.28	7.36	5.81	9.62	5.56	11.93	5.43
East South Central.....	1.60	3.60	1.63	4.14	1.91	5.06	2.55	5.89
West South Central.....	6.13	0.26	6.15	0.24	6.74	0.24	7.10	0.29
Mountain.....	1.39	4.45	1.12	4.85	1.47	6.02	1.79	6.92
Pacific.....	2.10	12.88	1.02	13.06	2.34	12.19	1.82	13.88
United States.....	77.34	44.49	71.84	44.83	86.31	44.02	97.30	47.30

Source: Federal Power Commission. * Estimated. † Includes output from wood.

AVE. HOURS USE OF GEN. CAPACITY



The Pacific Coast is still by far the largest user of water power. Approximately 30 per cent of all hydro energy is generated in the three Coast states. Similarly, more than 60 per cent of all fuel energy is generated in the two heavy industrial areas of the Middle Atlantic and East North Central states.

ENERGY SALES

ENERGY SALES TO ULTIMATE CONSUMERS

(In Millions of Kw.-Hr.)

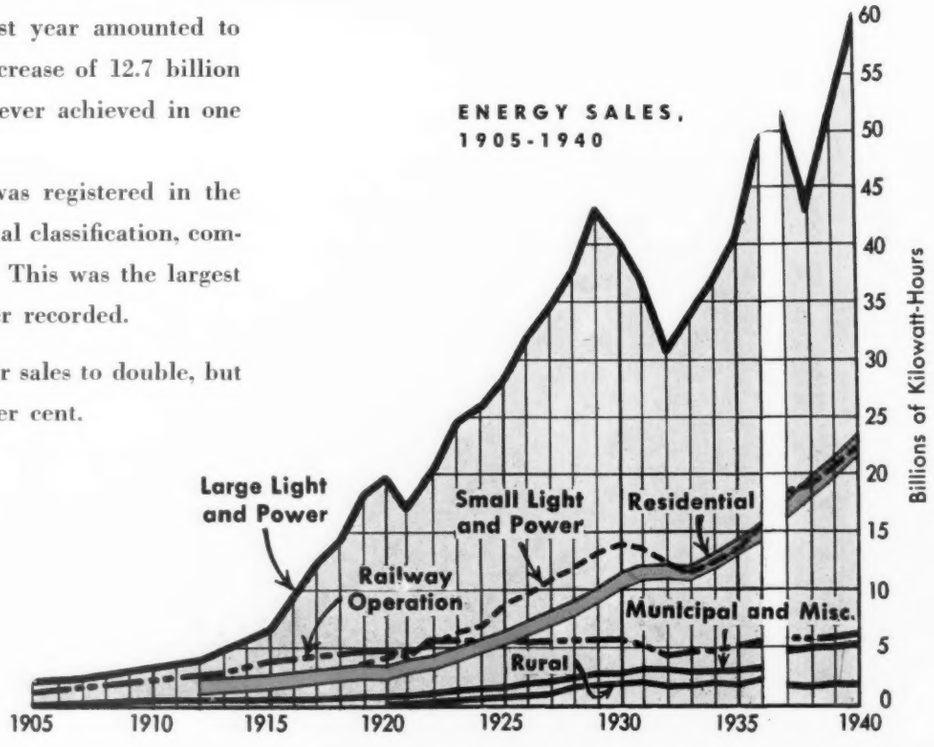
Year	Farm	Residential	Commercial Small Light and Power	Commercial Large Light and Power	Municipal Street Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total to ultimate Consumers
1927	861	7,538	10,766	34,539	1,741	5,039	504	262	61,251
1928	1,387	8,420	11,692	37,715	1,911	4,991	560	312	66,988
1929	1,602	9,526	13,106	42,971	2,038	5,049	590	412	75,294
1930	1,789	10,703	13,944	40,148	2,227	4,996	591	508	74,906
1931	1,879	11,373	13,544	36,937	2,330	4,549	626	664	71,902
1932	1,579	11,494	12,106	30,965	2,033	4,040	568	926	63,711
1933	1,633	11,358	11,589	33,857	1,893	3,991	668	927	65,916
1934	1,858	12,233	12,278	36,943	1,896	4,237	692	945	71,082
1935	1,693	13,496	13,588	40,864	2,078	4,194	841	842	77,596
1936	2,138	14,992	15,612	48,655	2,223	4,401	1,115	908	90,044
1937	2,389	16,875	17,558	53,546	1,909	4,450	1,265	1,453	99,446
1938	2,528	18,461	18,316	44,900	1,963	4,008	1,451	2,267	93,894
1939	3,320	19,740	20,235	52,773	1,835	3,900	1,847	2,437	106,087
1937†	1,670	17,691	18,075	51,360	1,863	4,428	1,284	2,987	99,359
1938†	1,577	19,371	19,137	43,140	1,929	3,989	1,449	3,138	93,731
1939†	1,881	21,084	20,722	51,108	2,002	3,918	1,847	3,205	105,768
1940†	2,014	23,230	22,239	59,560	2,144	3,971	1,926	3,403	118,487

Source: Edison Electric Institute. *Ten months actual, two months estimated.
†Revised figures to conform with Uniform System of Accounts prescribed by Federal Power Commission.

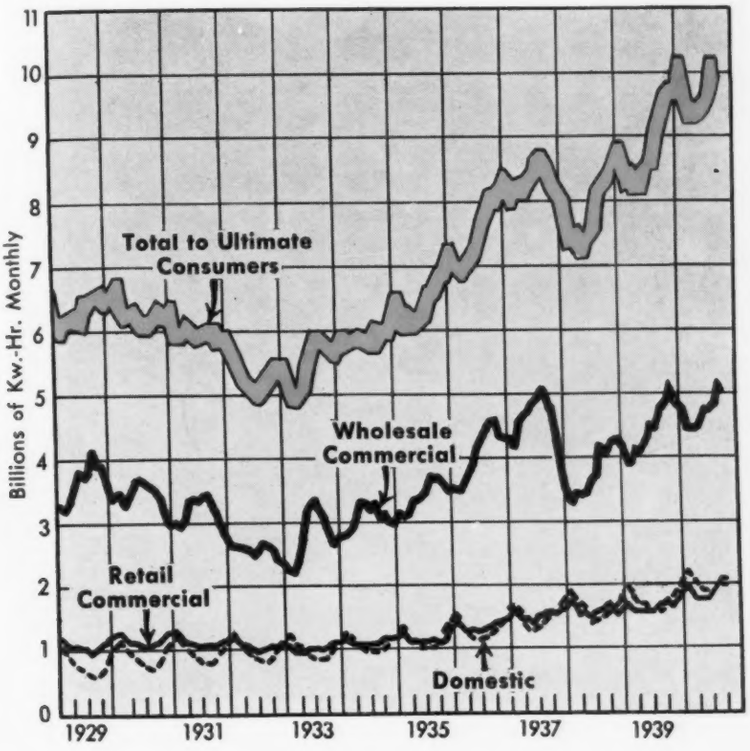
SALES to ultimate customers last year amounted to 118,487,000,000 kw.-hr. The increase of 12.7 billion kw.-hr. was the largest growth ever achieved in one year.

Two-thirds of this increase was registered in the large light and power commercial classification, commonly spoken of as industrial. This was the largest increase in industrial usage ever recorded.

It has taken fourteen years for sales to double, but the increase last year was 12 per cent.



ENERGY SALES BY CLASSES OF CUSTOMERS



Rural sales did not show as large a growth as in the previous year, reflecting a smaller increase in the number of rural customers.

Last year was the first time that the Federal Reserve Board Index of Production exceeded 1929—energy sales, on the other hand, have surpassed 1929 for the past six years. F. R. B. production index was up 10.7 per cent over 1929—energy sales were 57.4 per cent above 1929.

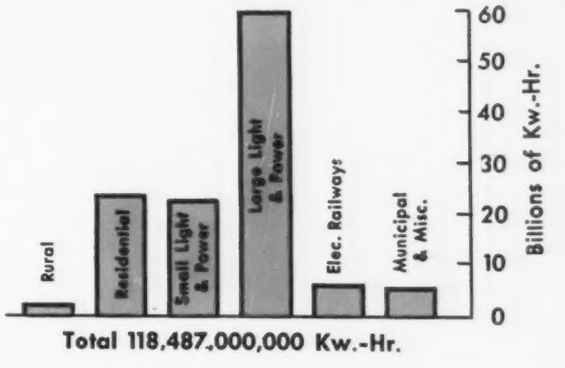
Industrial sales again were half the total and fast approaching the pre-depression ratio of 56 per cent. Residential remains at 20 per cent, but commercial has lost position. Its pre-depression ratio was 17 per cent, more recently it was approximately 20 per cent, but last year it fell below 19 per cent.

Residential usage, which in pre-depression years was 25 to 30 per cent below commercial, now appears to be permanently greater. For the past three years it has been exceeding commercial more and more and is now greater by a billion kw.-hr.

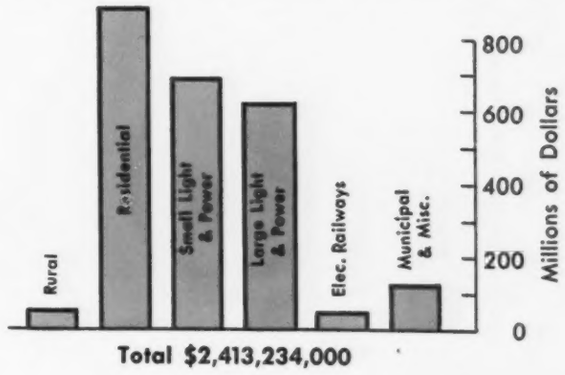
Residential sales increased 10.3 per cent last year. While total sales took fourteen years to double, residential took but seven years.

Street lighting is once more definitely pointing upward, sales showing a gain last year of 7.1 per cent.

ENERGY USES BY CLASSES OF CUSTOMERS



REVENUE BY CLASSES OF CUSTOMERS

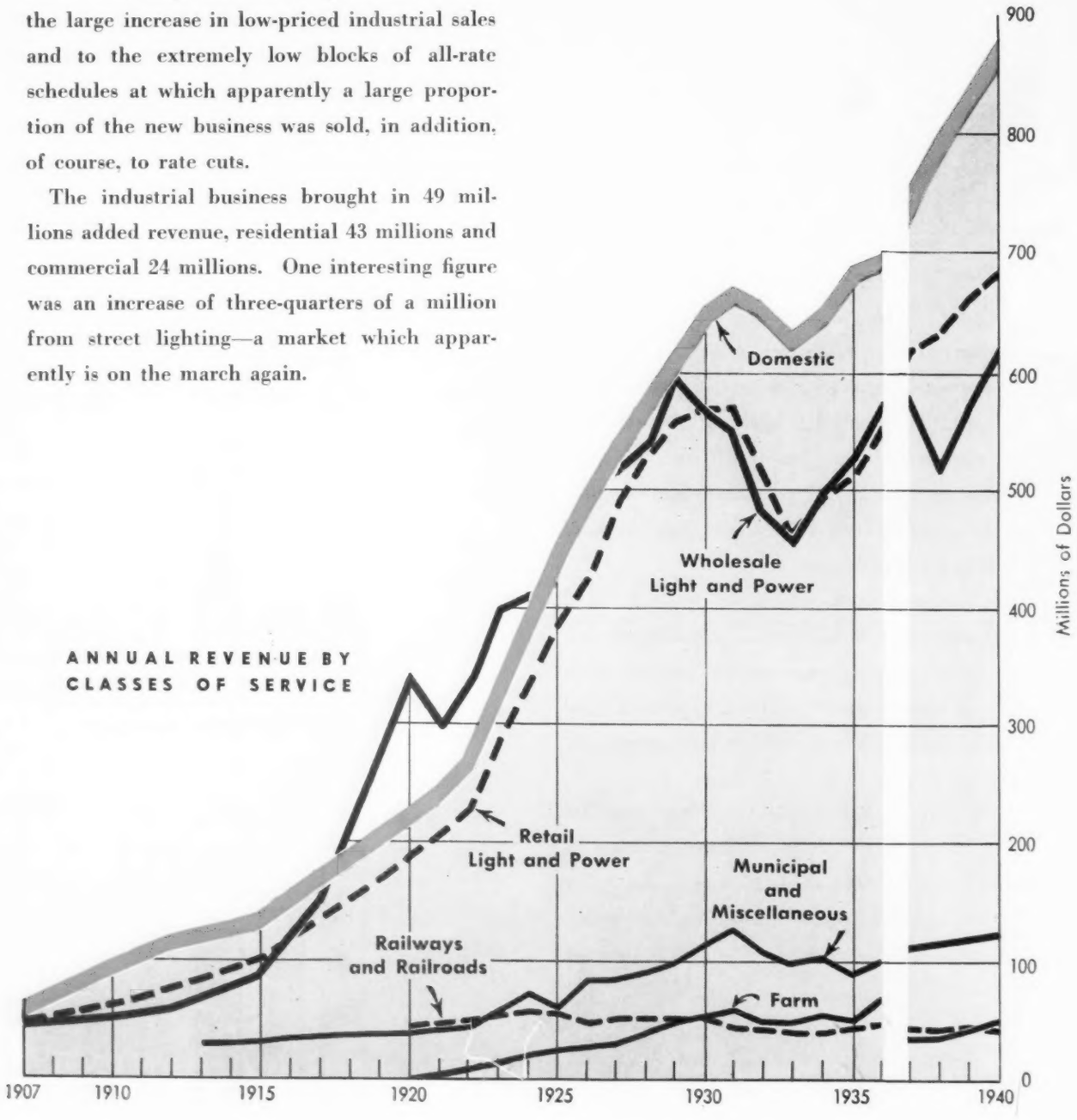


REVENUE

REVENUE from energy sales last year was the highest ever—$2,413,234,000.

The increase (5.4 per cent) was less than half that of the usage increase (12 per cent), due to the large increase in low-priced industrial sales and to the extremely low blocks of all-rate schedules at which apparently a large proportion of the new business was sold, in addition, of course, to rate cuts.

The industrial business brought in 49 millions added revenue, residential 43 millions and commercial 24 millions. One interesting figure was an increase of three-quarters of a million from street lighting—a market which apparently is on the march again.



REVENUE FROM ULTIMATE CONSUMERS (in Thousands of Dollars)

Year	Farm	Residential	Commercial Small Light and Power	Commercial Large Light and Power	Municipal Street Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total Revenue from Ultimate Consumers
1927	25,329	512,329	482,135	504,488	77,248	47,965	5,172	5,747	1,661,032
1928	36,540	555,894	519,957	529,173	83,024	46,488	5,559	7,670	1,743,809
1929	40,665	600,265	555,640	591,038	88,323	46,277	5,986	10,322	1,938,520
1930	46,689	642,275	575,598	566,467	95,458	46,067	6,015	12,382	1,990,955
1931	50,726	653,282	564,523	544,728	99,298	41,912	6,725	14,746	1,975,944
1932	47,127	640,384	500,993	474,424	89,828	36,701	6,181	18,076	1,813,717
1933	46,501	623,797	471,780	468,389	83,097	35,098	6,658	19,243	1,754,366
1934	49,182	648,801	490,420	499,451	81,846	36,402	6,680	19,085	1,831,870
1935	48,404	673,526	519,213	531,106	79,429	36,431	7,944	15,933	1,911,988
1936	59,286	696,997	562,122	581,148	80,791	37,423	9,591	17,225	2,044,586
1937	67,947	740,219	604,848	615,049	74,200	37,542	10,671	30,312	2,180,788
1938	75,946	778,003	609,281	545,947	74,700	34,072	12,035	¶38,511	2,168,495
1939	94,000	795,584	647,671	595,007	72,244	32,460	14,429	42,249	2,293,643
1937†	37,726	759,824	616,438	583,197	72,740	37,019	10,761	43,091	2,160,798
1938†	38,928	802,532	632,091	518,694	74,323	33,512	11,995	44,504	2,156,580
1939†	45,484	843,158	660,683	572,659	75,443	32,573	14,427	45,154	2,289,583
1940†*	49,674	885,900	684,740	621,890	76,160	32,349	14,717	47,804	2,413,234

Source: Edison Electric Institute. * Ten months actual, two months estimated. † Revised figures conforming with Uniform System of Accounts prescribed by Federal Power Commission. ¶ About 4,000 in interdep't not previously incl. in sales.

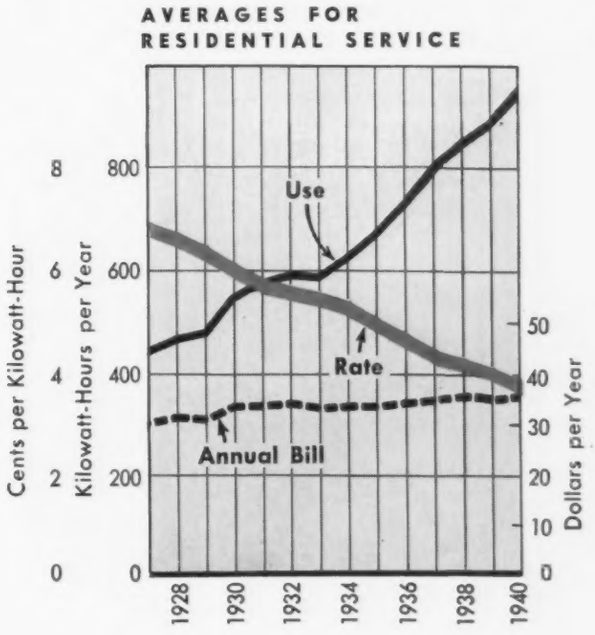
RESIDENTIAL SERVICE
to Urban and Non-Farm Homes

Year	Kw.-Hr. per Customer	Average Annual Bill (Dollars)	Revenue per Kw.-Hr. (Cents)
1926	428	29.87	6.98
1929	499	31.44	6.30
1930	543	32.58	6.00
1931	578	33.18	5.74
1932	597	33.25	5.57
1933	595	32.67	5.49
1934	624	33.07	5.30
1935	672	33.53	4.99
1936	727	33.81	4.65
1937	805	34.62	4.30
1938	853	35.31	4.14
1939	897	35.88	4.00
1940*	952	36.27	3.81

Source: Edison Electric Institute. * Estimated.

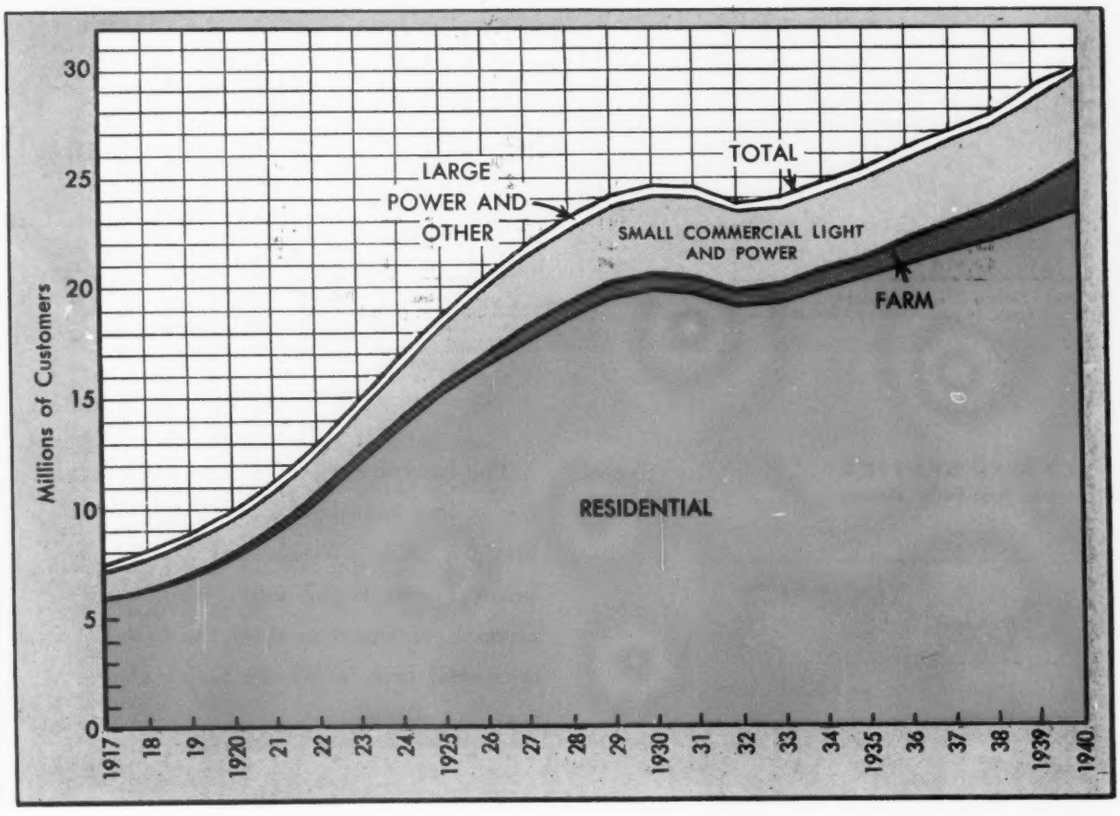
Average annual residential usage was up about 1 kw.-hr. a week to 952, with an average bill of $36.27. This brings the average rate below 4 cents for the first time—3.81 cents. In the past ten years the average residential usage has increased 75 per cent. During the same period the average bill has increased but 11 per cent, or one-seventh as fast as usage.

The increment rate for the additional 8½ billion industrial kw.-hr. sales was low, 5.8 mills. Residential again fell below 1 cent to 7.1 mills, while commercial continued to show the best incremental rate of all the major classifications, 1.6 cents.



CUSTOMERS

NUMBERS OF ELECTRICITY CUSTOMERS



THE YEAR CLOSED with just over 30 million customers, an increase of approximately one million.

Almost 90 per cent of the numerical gain in customers occurred in the residential bracket.

Changes in classification to agree with F.P.C. records may cause some confusion when these data are compared with issues of previous years. This is especially true of "rural" and "commercial." The data on the opposite page, however, are comparable. They show an 8.2 per cent gain in rural, or approximately 52,000.

The total gained, however, on rural lines was probably nearer 300,000, many of which were classified as residential because of town residence and some as commercial.

Commercial and industrial customers combined were greater by 42,149, as compared to a "loss" last year due to reclassification.

CENTRAL STATION CUSTOMERS AT END OF YEAR*

Regional or State	Total Number			Rural (Distinct Rural Rates)			Residential			Commercial and Industrial			Municipal, Rail and Miscellaneous		
	1940	1939	Change in 1940	1940	1939	Change in 1940	1940	1939	Change in 1940	1940	1939	Change in 1940	1940	1939	Change in 1940
UNITED STATES	**30,091,488**	**29,105,306**	**986,182**	**686,127**	**634,249**	**51,878**	**24,850,500**	**23,965,035**	**885,465**	**4,441,702**	**4,399,553**	**42,149**	**113,159**	**106,469**	**6,690**
NEW ENGLAND	**2,518,869**	**2,482,126**	**36,743**	**4,390**	**4,228**	**162**	**2,148,700**	**2,114,147**	**34,553**	**358,290**	**356,395**	**1,895**	**7,489**	**7,356**	**133**
Maine	224,006	218,042	5,964	860	840	20	185,700	180,540	5,160	35,000	34,258	742	2,446	2,404	42
New Hampshire	148,902	144,259	4,643	160	170	−10	127,000	122,587	4,413	19,920	19,751	169	1,822	1,751	71
Vermont	92,469	90,896	1,573	1,640	1,566	74	75,200	73,800	1,400	14,820	14,716	104	809	814	−5
Massachusetts	1,326,406	1,307,777	18,629	1,000	937	63	1,132,500	1,114,385	18,115	190,900	190,474	426	2,006	1,981	25
Rhode Island	210,875	216,684	−5,809	270	260	10	182,000	187,336	−5,336	28,350	28,834	−484	255	254	1
Connecticut	516,211	504,468	11,743	460	455	5	446,300	435,499	10,801	69,300	68,362	938	151	152	−1
MIDDLE ATLANTIC	**7,827,197**	**7,683,944**	**143,253**	**32,930**	**30,397**	**2,533**	**6,597,000**	**6,462,791**	**134,209**	**1,172,450**	**1,171,808**	**642**	**24,817**	**18,948**	**5,869**
New York	4,065,902	4,015,453	50,449	560	440	120	3,410,000	3,364,400	45,600	641,100	642,350	−1,250	14,242	8,263	5,979
New Jersey	1,290,204	1,255,411	34,793	70	516	−446	1,087,000	1,051,020	35,980	200,850	201,523	−673	2,284	2,352	−68
Pennsylvania	2,471,091	2,413,080	58,011	32,300	29,441	2,859	2,100,000	2,047,371	52,629	330,500	327,935	2,565	8,291	8,333	−42
EAST NORTH CENTRAL	**7,114,913**	**6,894,973**	**219,940**	**230,630**	**231,566**	**19,064**	**5,943,000**	**5,755,949**	**187,051**	**899,760**	**835,390**	**14,370**	**21,523**	**22,068**	**−545**
Ohio	1,890,110	1,839,567	50,543	73,000	66,862	6,138	1,580,000	1,536,131	43,869	227,700	226,861	839	9,410	9,713	−303
Indiana	884,150	855,025	29,125	57,000	53,144	3,856	708,000	684,281	23,719	113,600	112,299	1,301	5,550	5,301	249
Illinois	2,101,770	2,047,739	54,031	42,000	37,239	4,761	1,790,000	1,747,299	42,701	267,300	260,811	6,489	2,470	2,390	80
Michigan	1,449,499	1,384,570	64,929	11,630	10,004	1,626	1,257,000	1,197,898	59,102	178,960	174,743	4,212	1,909	1,920	−11
Wisconsin	789,384	768,072	21,312	67,000	64,317	2,683	608,000	590,340	17,660	112,200	110,671	1,529	2,184	2,744	−560
WEST NORTH CENTRAL	**2,865,711**	**2,776,390**	**89,321**	**98,600**	**89,246**	**9,354**	**2,281,600**	**2,208,589**	**73,011**	**474,825**	**468,361**	**6,464**	**10,686**	**10,194**	**492**
Minnesota	598,812	579,000	19,812	13,200	13,092	108	484,200	465,780	18,420	99,610	98,350	1,260	1,802	1,778	24
Iowa	583,850	563,071	20,779	33,000	31,045	1,955	454,000	436,101	17,899	94,910	94,085	825	1,940	1,840	100
Missouri	801,832	778,133	23,699	24,000	20,901	3,099	650,000	631,743	18,257	125,900	123,919	1,981	1,932	1,570	362
North Dakota	90,569	85,705	4,864	400	386	14	66,400	64,089	2,311	23,155	20,509	2,646	614	721	−107
South Dakota	102,580	99,113	3,467	1,600	1,555	45	77,000	73,893	3,107	23,300	23,009	291	680	656	24
Nebraska	290,197	282,470	7,727	10,000	7,894	2,106	234,000	227,547	6,453	45,050	45,873	−823	1,147	1,156	−9
Kansas	397,871	388,898	8,973	16,400	14,373	2,027	316,000	309,436	6,564	62,900	62,616	284	2,571	2,473	98
SOUTH ATLANTIC	**2,730,005**	**2,568,359**	**161,646**	**80,700**	**73,276**	**7,424**	**2,231,600**	**2,080,313**	**151,287**	**407,192**	**404,639**	**2,553**	**10,513**	**10,131**	**382**
Delaware	55,125	57,187	−2,062	400	337	63	51,100	47,469	3,631	3,385	9,128	−5,743	240	253	−13
Maryland-Dist. of Columbia	587,947	568,607	19,340	22,000	20,010	1,990	487,000	470,397	16,603	78,497	77,754	743	450	446	4
Virginia	426,588	396,539	30,049	8,800	7,970	830	354,000	327,834	26,166	61,350	58,389	2,961	2,438	2,346	92
West Virginia	292,886	274,390	18,496	20,500	18,107	2,393	234,000	219,006	14,994	36,600	35,491	1,109	1,786	1,786	0
North Carolina	440,491	409,274	31,217	20,500	18,829	1,671	350,000	321,520	28,480	68,515	67,445	1,070	1,476	1,480	−4
South Carolina	182,978	171,142	11,836	6,300	5,877	423	145,500	134,639	10,861	30,825	30,240	585	353	386	−33
Georgia	359,894	332,419	27,475	0	0	0	300,000	273,913	26,087	59,170	57,868	1,302	724	638	86
Florida	384,096	358,801	25,295	2,200	2,146	54	310,000	285,535	24,465	68,850	68,324	526	3,046	2,796	250
EAST SOUTH CENTRAL	**1,206,078**	**1,114,949**	**91,129**	**60,180**	**56,075**	**4,025**	**965,000**	**874,534**	**90,466**	**175,215**	**178,882**	**−3,667**	**5,763**	**5,458**	**305**
Kentucky	374,010	342,101	31,909	12,800	10,501	2,299	304,000	276,206	27,794	54,090	52,302	1,788	3,120	3,092	28
Tennessee	376,771	353,249	23,522	7,000	5,883	1,117	317,000	288,925	28,075	52,100	58,057	−5,957	671	384	287
Alabama	292,332	273,334	18,998	31,500	31,505	−5	221,000	202,562	18,438	39,200	38,564	636	632	703	−71
Mississippi	162,965	146,265	16,700	8,800	8,186	614	123,000	106,841	16,159	29,825	29,959	−134	1,340	1,279	61
WEST SOUTH CENTRAL	**1,842,354**	**1,757,161**	**85,193**	**43,970**	**39,988**	**3,982**	**1,472,200**	**1,396,606**	**75,594**	**314,380**	**308,857**	**5,523**	**11,804**	**11,710**	**94**
Arkansas	182,158	170,753	11,405	6,700	6,397	303	139,200	129,032	10,168	34,380	33,336	1,044	1,878	1,988	−110
Louisiana	313,731	298,634	15,097	470	841	−371	263,000	248,582	14,418	49,140	48,146	994	1,121	1,065	56
Oklahoma	348,742	338,471	10,271	12,800	11,983	817	270,000	260,983	9,017	63,510	63,039	471	2,432	2,466	−34
Texas	997,723	949,303	48,420	24,000	20,767	3,233	800,000	758,009	41,991	167,350	164,336	3,014	6,373	6,191	182
MOUNTAIN	**860,981**	**834,445**	**26,536**	**15,167**	**14,034**	**1,073**	**707,400**	**683,571**	**23,829**	**133,490**	**131,976**	**1,514**	**4,984**	**4,864**	**120**
Montana	122,020	116,228	5,792	3	0	3	103,000	97,405	5,595	17,620	17,399	221	1,397	1,424	−27
Idaho	124,106	116,279	7,827	4,000	3,489	511	101,000	94,069	6,931	17,660	17,328	332	1,446	1,393	53
Wyoming	47,876	45,713	2,163	370	314	56	39,600	37,881	1,719	7,800	7,420	380	106	98	8
Colorado	258,604	253,734	4,870	8,500	8,196	304	203,500	199,308	4,192	46,000	45,700	300	604	530	74
New Mexico	49,499	47,601	1,898	4	0	4	39,300	37,851	1,449	10,000	9,563	437	195	187	8
Arizona	100,293	97,645	2,648	1,600	1,451	149	82,000	79,857	2,143	16,380	16,053	327	313	284	29
Utah	131,838	131,778	60	630	584	46	117,000	116,189	811	13,330	14,097	−767	878	908	−30
Nevada	26,745	25,467	1,278	0	0	0	22,000	21,011	989	4,700	4,416	284	45	40	5
PACIFIC	**3,125,380**	**2,992,959**	**132,421**	**99,700**	**95,439**	**4,261**	**2,504,000**	**2,388,535**	**115,465**	**506,100**	**493,245**	**12,855**	**15,580**	**15,740**	**−160**
Washington	535,124	520,283	14,841	20,000	18,558	1,442	441,000	428,852	12,148	71,700	70,584	1,116	2,424	2,289	135
Oregon	314,336	297,053	17,283	8,700	7,312	1,388	258,000	241,408	16,592	46,200	46,697	−497	1,436	1,636	−200
California	2,275,920	2,175,623	100,297	71,000	69,569	1,431	1,805,000	1,718,275	86,725	388,200	375,964	12,236	11,720	11,815	−95

Source: Edison Electric Institute. * 1940 estimated. Indicated losses are in general due to reclassification.

PEAKS AND RESERVES

THE FEDERAL POWER COMMISSION has embarked upon a continuing study of adequacy of power supply of the nation. Material for the study is supplied by electric utilities in monthly reports of requested information which is developed by the commission into the combined data tabulation as shown on the facing page. The data are presented for the regions designated by numbers on the map. The table here reproduced is for October, 1940, and is the second in the series of monthly releases. The first release included, and succeeding quarterly releases will include, some 50 graphs showing relationship between peaks, net assured capacity and dependable capacity and between generation and energy for load.

These data on peaks and reserves will be studied in connection with the results of an FPC survey of demands, energy usages and productions of 25,000 industrial plants to determine power adequacies in relation to industrial productions in the defense emergency.

ELECTRIC POWER SUPPLY AREAS IN THE UNITED STATES

ELECTRIC POWER REQUIREMENTS AND SUPPLY by Power Supply Areas, October, 1940

CLASS I ELECTRIC UTILITY SYSTEMS (Peaks 15,000 Kw. or Higher)

Area number	Actual requirements during October, 1940					Forecast of future requirements									Required reserves October 1940 Kw.	Net assured capacity to serve annual peak load (Based on facilities and contracts in service or scheduled for service on dates shown)				Area number
	Net generation			Energy for load 1,000 Kw.-Hr.	Peak load Kw.	November		December		January, 1941		Maximum requirements in next 12 months				End of Oct. 1940 Kw.	End of 1940 Kw.	End of 1941 Kw.	End of 1942 Kw.	
	Hydro 1,000 Kw.-Hr.	Fuel 1,000 Kw.-Hr.	Total 1,000 Kw.-Hr.			Energy 1,000 Kw.-Hr.	Peak Kw.	Energy 1,000 Kw.-Hr.	Peak Kw.	Energy 1,000 Kw.-Hr.	Peak Kw.	Month and year	Energy 1,000 Kw.-Hr.	Peak Kw.						
1	77,875	12,636	90,511	91,106	182,535	93,000	193,000	98,000	198,000	94,500	190,000	Dec. 1940	98,000	198,000	12,500	201,750	202,850	202,850	222,850	1
2	83,113	536,142	619,255	662,991	1,511,442	638,142	1,561,100	665,730	1,580,700	673,076	1,548,400	Dec. 1940	665,730	1,580,700	258,875	1,799,480	1,799,480	1,916,060	1,974,060	2
3	422,443	382,160	804,603	1,021,801	1,850,745	1,017,299	1,848,225	1,037,691	1,871,425	1,019,961	1,819,100	Dec. 1940	1,037,691	1,871,425	199,550	1,767,582	1,842,582	1,952,582	2,027,582	3
4	0	722,529	722,529	704,811	1,710,834	686,628	1,779,000	745,479	1,837,000	731,839	1,787,000	Dec. 1940	745,479	1,837,000	340,000	2,261,550	2,261,550	2,444,550	2,504,550	4
3 & 4	422,443	1,104,689	1,527,132	1,726,612	3,561,579	1,703,927	3,627,225	1,783,170	3,708,425	1,751,800	3,606,100	Dec. 1940	1,783,170	3,708,425	539,550	4,029,132	4,104,132	4,397,132	4,332,132	3 & 4
5	61,490	1,030,335	1,091,825	1,110,782	2,390,274	1,079,800	2,461,300	1,148,000	2,540,700	1,152,700	2,464,500	Oct. 1941	1,200,000	2,550,000	335,300	2,590,173	2,690,173	2,911,527	3,101,527	5
6	44,037	283,855	327,892	306,514	608,000	301,900	642,000	315,800	665,000	318,200	653,000	Dec. 1940	315,800	665,000	80,650	662,000	662,000	718,000	826,000	6
7	10,427	537,909	548,336	550,421	1,084,159	541,422	1,089,500	562,000	1,109,500	564,200	1,094,000	Dec. 1940	562,000	1,109,500	147,660	1,238,786	1,238,786	1,315,786	1,402,882	7
8	0	209,648	209,648	207,969	451,400	215,300	475,000	226,800	489,500	227,500	475,500	Oct. 1941	237,800	509,500	105,500	518,000	518,000	574,000	644,000	8
9	247	516,219	516,466	499,766	988,734	496,807	1,005,000	508,400	1,015,000	514,200	1,023,000	Oct. 1941	560,000	1,100,000	166,500	1,011,350	1,037,600	1,210,100	1,270,100	9
10	33,298	194,718	228,016	218,733	416,700	205,300	416,000	216,350	415,000	207,400	415,000	Sept. 1941	235,000	460,000	40,048	505,000	520,000	520,000	605,000	10
11	38,947	507,701	546,648	549,027	1,248,685	534,420	1,286,000	566,910	1,320,000	571,950	1,295,500	Oct. 1941	603,000	1,360,000	211,000	1,533,770	1,533,770	1,618,770	1,693,770	11
12	25,853	394,090	419,943	440,499	961,519	441,133	1,031,200	463,625	1,069,900	454,182	1,012,600	Oct. 1941	490,000	1,080,000	212,410	1,107,334	1,107,334	1,255,834	1,410,834	12
9, 10, 12	59,398	1,105,027	1,164,425	1,158,998	2,366,953	1,143,240	2,452,200	1,182,375	2,499,900	1,175,782	2,450,600	Oct. 1941	1,240,000	2,630,000	418,958	2,623,684	2,664,934	2,985,934	3,285,934	9, 10, 12
13	55,507	179,236	234,743	237,792	555,961	235,759	568,630	243,523	585,046	248,886	579,565	Oct. 1941	263,000	610,000	110,910	604,500	606,500	668,500	668,500	13
14	5,516	571,269	576,785	753,678	1,641,033	738,896	1,703,100	776,540	1,753,900	781,573	1,706,600	Oct. 1941	770,000	1,800,000	411,680	1,706,070	1,706,070	1,859,820	1,999,820	14
15	45,921	209,408	255,329	219,443	433,060	228,556	464,100	234,787	475,500	232,498	454,000	July 1941	247,866	507,900	101,000	519,517	544,517	579,517	579,517	15
16	68,940	111,169	180,109	186,058	392,481	183,100	404,800	188,000	408,200	183,800	398,400	Dec. 1940	188,000	408,200	67,100	453,875	471,375	521,375	521,375	16
17	989	81,113	82,102	81,714	192,446	82,830	204,630	83,471	211,846	80,393	204,817	Dec. 1940	83,471	211,846	70,900	246,495	246,495	266,495	266,495	17
18	8,381	124,412	132,793	114,616	254,900	112,511	264,000	117,880	271,000	118,800	258,000	Oct. 1941	129,800	283,000	58,500	276,800	294,800	334,800	334,800	18
19	180	24,504	24,684	33,857	74,000	34,600	75,000	35,000	78,000	34,500	75,000	Dec. 1940	35,000	78,000	15,000	81,540	81,540	81,540	81,540	19
20	524,492	54,454	578,946	469,021	836,120	453,350	836,000	462,350	851,000	469,350	846,000	Oct. 1941	515,350	926,000	103,000	754,550	754,550	834,550	1,182,550	20
21	187,271	250,137	437,408	490,208	1,010,746	481,460	1,008,300	482,552	1,028,500	465,252	1,009,600	Oct. 1941	540,000	1,130,000	109,680	984,950	984,950	1,114,950	1,114,950	21
22 & 23	153,237	175,350	328,587	435,964	895,300	417,915	900,900	408,633	911,200	423,633	900,900	Oct. 1941	458,633	971,200	74,500	936,200	936,200	1,076,200	1,076,200	22 & 23
24	1,064	101,344	102,408	90,001	213,000	94,500	238,900	102,850	264,400	113,250	274,000	Feb. 1941	113,350	277,400	54,550	266,318	296,318	326,318	326,318	24
25	3,510	111,025	114,535	129,806	270,920	125,447	263,000	123,211	273,000	119,093	246,000	Sept. 1941	151,000	307,000	71,500	280,707	280,707	287,707	287,707	25
26	113	10,016	10,129	10,129	27,565	10,166	30,759	10,247	33,000	9,872	29,000	Dec. 1940	10,247	33,000	10,000	34,296	34,296	34,296	34,296	26
27	0	9,627	9,627	9,627	24,290	10,000	26,500	10,300	28,000	10,100	25,000	Dec. 1940	10,300	28,000	5,146	29,654	30,324	30,324	30,324	27
28	281	45,093	45,374	50,327	108,190	46,500	106,000	49,400	117,000	49,750	109,500	July 1941	55,800	122,900	37,750	123,270	123,270	177,770	177,770	28
29	88	122,840	122,928	119,104	252,931	114,645	249,700	121,024	262,200	117,674	252,500	July 1941	129,000	280,200	146,000	311,133	311,133	311,133	311,133	29
30	152,874	0	152,874	148,340	244,100	145,000	245,000	150,000	245,000	150,000	245,000	Dec. 1940	150,000	245,000	34,980	266,720	266,720	266,720	301,720	30
31	No Class	I System																		31
32	10,065	38,364	48,429	48,665	109,825	47,200	114,400	49,900	117,400	50,410	113,400	Dec. 1940	49,900	117,400	32,800	119,771	119,771	152,271	152,271	32
33	15	86,618	86,633	93,813	203,839	89,533	197,800	89,053	202,800	88,862	195,680	Sept. 1941	97,963	216,500	63,152	223,485	223,485	268,485	268,485	33
34	231	54,140	54,371	48,425	97,100	46,887	95,800	47,674	102,800	48,350	97,700	Aug. 1941	52,500	105,000	35,000	113,900	113,900	113,900	113,900	34
35	0	64,791	64,791	64,339	112,300	65,000	115,000	65,600	116,000	65,300	115,500	July 1941	72,000	120,000	34,000	148,000	148,000	148,000	148,000	35
36	0	26,888	26,888	26,888	57,500	27,675	59,650	27,875	60,300	26,625	55,750	July 1941	31,300	64,500	42,400	56,515	56,515	56,515	69,015	36
37	14,368	170,758	185,126	179,266	408,481	171,008	389,720	168,444	400,420	164,991	366,840	Sept. 1941	206,000	444,000	79,975	443,685	443,685	474,085	480,085	37
38	6,362	106,887	113,249	114,185	248,457	107,000	252,650	114,250	269,000	112,000	242,500	Sept. 1941	141,300	296,000	75,000	287,836	287,836	318,936	328,936	38
39	0	14,547	14,547	14,550	30,000	14,500	31,000	12,911	34,200	14,370	30,900	Dec. 1940	12,911	34,200	13,000	29,500	29,500	44,500	44,500	39
40	0	73,335	73,335	137,455	314,216	135,400	334,000	143,600	350,500	143,300	345,000	Oct. 1941	153,000	360,000	30,500	328,925	330,925	390,925	390,925	40
41	78,649	39,196	117,845	119,747	224,182	120,700	229,000	122,900	235,500	121,200	227,500	Aug. 1941	138,500	249,000	35,000	245,500	245,500	245,500	245,500	41
42 & 44	217,730	53,060	270,790	270,017	528,500	257,582	542,800	290,004	575,600	288,036	570,200	Oct. 1941	376,307	696,700	82,240	577,550	641,550	1,029,550	1,137,550	42 & 44
43	193,613	6,312	199,925	195,287	452,184	197,597	452,000	204,382	465,000	207,595	468,000	Oct. 1941	220,000	490,000	79,500	515,833	515,833	528,333	528,333	43
42, 43, 44	411,343	59,372	470,715	465,304	980,684	455,179	994,800	494,386	1,040,500	495,631	1,038,200	Oct. 1941	596,307	1,186,700	161,740	1,095,383	1,159,383	1,559,883	1,667,883	42, 43, 44
45	49,290	8,404	57,694	35,697	81,710	34,300	80,500	35,850	80,500	35,200	80,500	Aug. 1941	37,700	84,000	0	60,825	60,825	60,825	60,825	45
46	349,746	66,493	416,239	536,518	1,128,733	505,800	1,098,200	515,700	1,127,250	504,900	1,099,000	July 1941	655,600	1,215,000	76,000	1,126,750	1,214,750	1,258,750	1,333,750	46
45 & 46	399,036	74,897	473,933	572,215	1,210,443	540,100	1,178,700	551,550	1,207,750	540,100	1,179,500	July 1941	693,300	1,299,000	76,000	1,187,575	1,275,575	1,319,575	1,394,575	45 & 46
47	571,678	66,184	637,862	564,428	1,301,730	551,788	1,298,400	549,916	1,306,500	545,848	1,297,700	Oct. 1941	630,000	1,400,000	310,000	1,435,885	1,435,885	1,548,385	1,733,385	47
48	2,555	15,215	17,770	44,681	81,375	40,961	73,000	41,455	75,000	41,962	73,500	Aug. 1941	75,646	117,000	20,800	78,775	78,775	121,275	151,275	48
47 & 48	574,233	81,399	655,632	609,109	1,383,105	592,749	1,371,400	591,371	1,381,500	587,810	1,371,200	Oct. 1941	683,000	1,497,000	330,800	1,514,660	1,514,660	1,669,660	1,884,660	47 & 48

EXPENSES

OPERATING REVENUE, EXPENDITURES, TAXES

Privately Owned Establishments

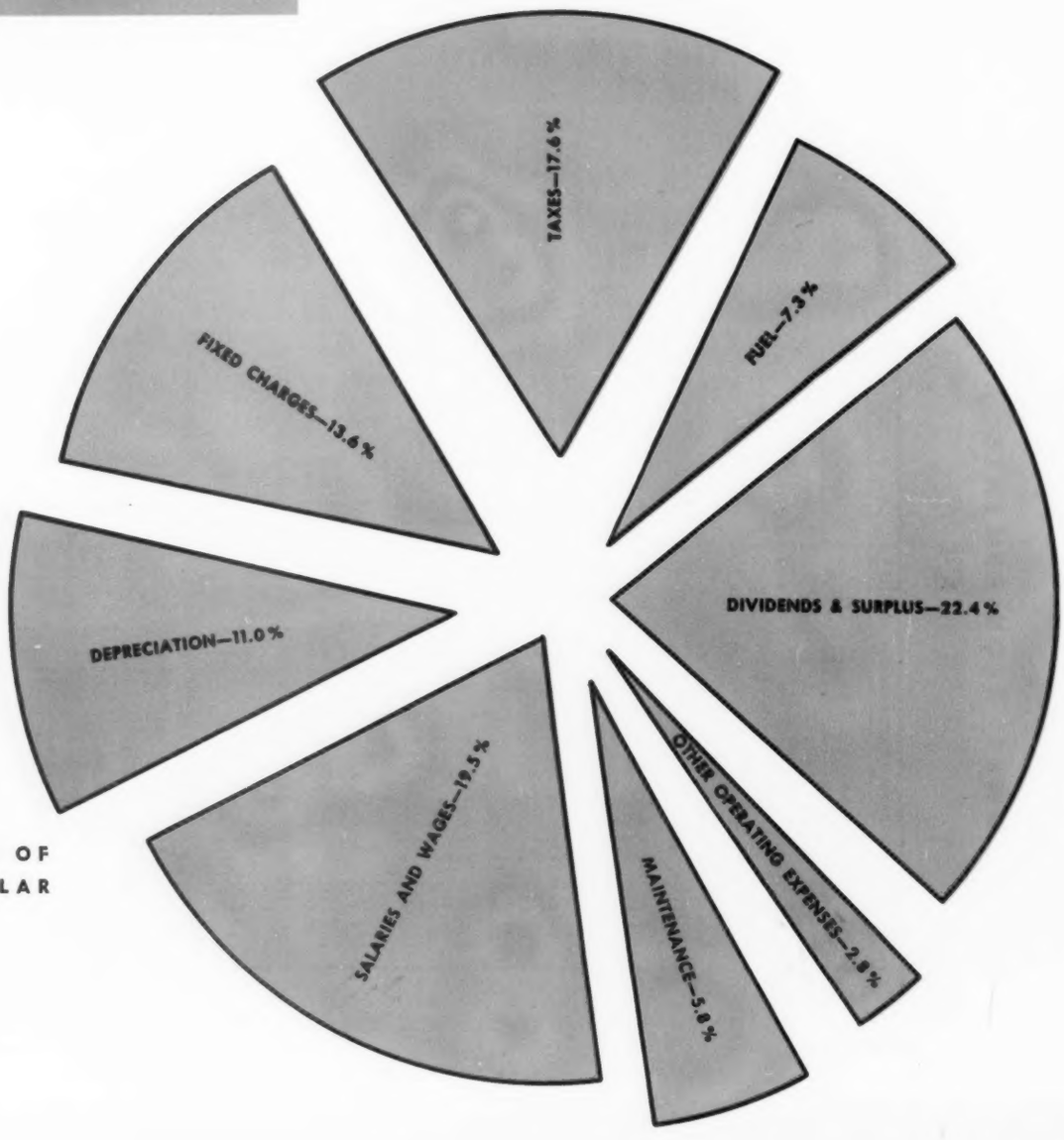
	Operating Revenue	Operating Expenditures	Taxes
1932..	$1,719,000,000	$616,000,000	$205,000,000
1933..	1,664,000,000	598,000,000	215,000,000
1934..	1,736,000,000	636,000,000	243,000,000
1935..	1,813,000,000	669,000,000	255,000,000
1936..	1,941,000,000	725,000,000	286,000,000
1937..	2,050,000,000	790,000,000	312,000,000
1938..	2,035,000,000	772,000,000	330,000,000
1939..	2,141,000,000	802,000,000	340,000,000
1940*.	2,265,000,000	850,000,000	405,000,000

Source: Edison Electric Institute.
* Subject to year-end revisions.

OPERATING EXPENSES of 850 millions showed an increase during the year of 48 millions; taxes of 405 millions, an increase of 65 millions—aggregate increase 113 millions. Operating revenue was up 124 millions—net gain from operations, and after taxes, 11 millions.

Taxes increased almost twice as much as the increase in any previous year. They are now twice what they were in 1932 and take approximately 18 cents out of every dollar of operating income.

ALLOCATION OF REVENUE DOLLAR



OPERATING RATIO BEFORE AND AFTER TAXES

Privately Owned Establishments

	1932	1933	1934	1935	1936	1937	1938	1939	1940
Before Taxes.....	35.7	36.0	36.6	36.9	37.3	38.5	37.3	37.4	37.5
After Taxes.....	47.8	48.8	50.6	50.9	52.2	53.8	54.2	53.3	55.3

EMPLOYEES, PAYROLLS, FUEL, MAINTENANCE

Private and Municipal Establishments

	Number of Employees	Thousands of Dollars		
		Payroll	Fuel Cost	Maintenance
1937..	279,000	470,353	173,000	131,000
1938..	270,000	460,000	156,000	132,000
1939..	269,000	469,500	188,000	137,000
1940..	275,000	488,000	215,000	145,000

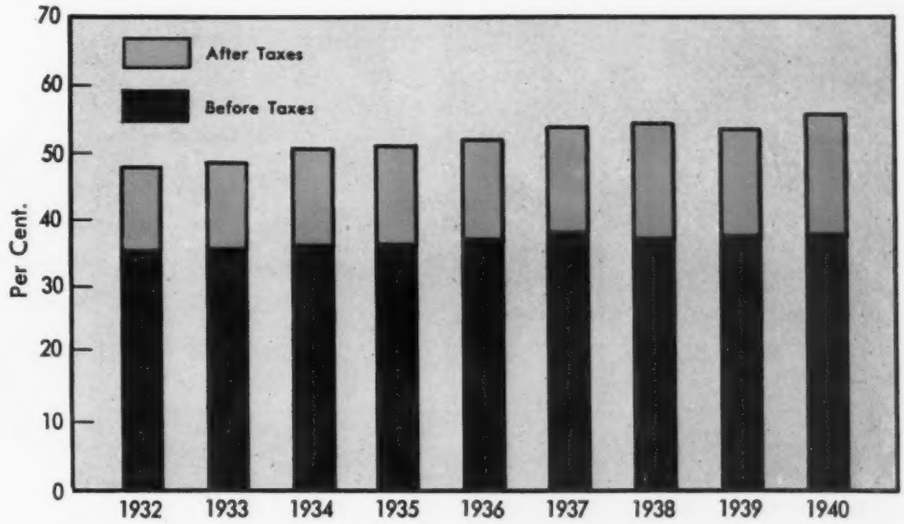
Estimated by ELECTRICAL WORLD on U. S. Census and E.E.I. data.

Compared with 1939, the allocation of the revenue dollar for 1940 shows 2.7 cents more for taxes, 0.6 cent more for depreciation and 0.2 cent more for "other operating expenses." Consequently there are reductions in the shares of other claimants on the dollar. Fuel is down 0.6 cent. reflecting improved fuel economy and larger output. Fixed charges are down 1.4 cents, indicating the effect of lower cost of mortgage money.

The aggregate of all increases in operating expenses above the 1932 level for the intervening eight years is 914 millions, of taxes 746 million and depreciation and retirement (not shown in accompanying data) 313 millions, a total of 1,973 millions. Using the same 1932 base, the aggregate increase in operating revenue for the same eight years is 1,893 millions. All of which means that in the period of recovery expenses were growing faster than income at the rate of approximately 10 millions a year. Refunding of bonds and preferred stocks at lower yields has made it possible to overcome this trend and show a fair return.

The operating ratio at 37.5 stays fairly steady. It is only when taxes are added that a steady climb is noticed, standing at the end of 1940 at 55.3.

OPERATING RATIO BEFORE AND AFTER TAXES



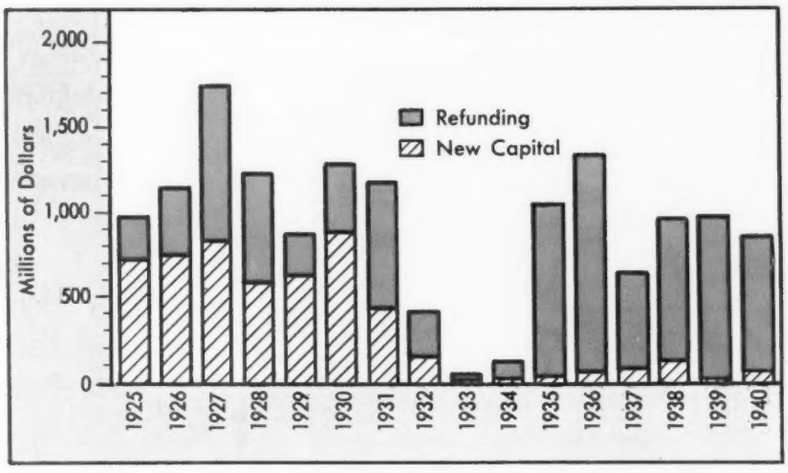
FINANCIAL

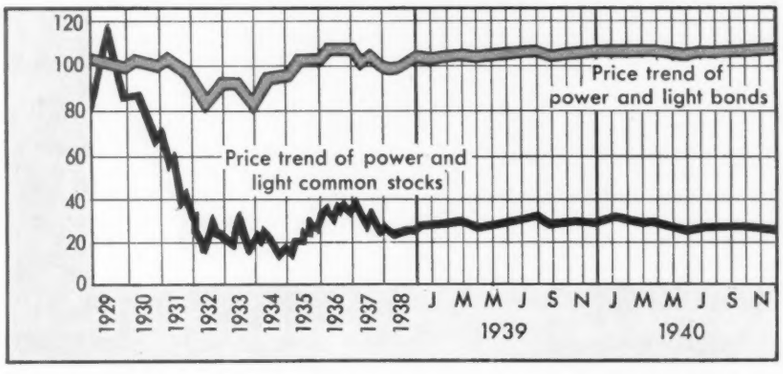
TOTAL FINANCING in 1940 amounted to $989,459,320, approximately the same as in the previous year.

Less than 10 per cent was new capital, 90.7 per cent being refunding. Of the 92 millions new capital 8 million was in preferred and 6 million in common.

There were 77 issues, of which 49 were bonds, 6 debentures, 4 notes, 16 preferred stock and 2 common stock.

SECURITIES ISSUED TO PUBLIC AND INSTITUTIONAL INVESTORS





PRICE TRENDS OF ELECTRIC UTILITY SECURITIES

NEW UTILITY FINANCING TOTALS $989,459,320

No. of Issues	Range of Yield	Amount of Issues
Mortgage Bonds (Av. yield 3.04%)		
5	2.51–2.78	$264,500,000
11	2.80–2.99	197,782,300
9	3.00–3.15	135,600,000
5	3.29–3.61	105,850,000
6	3.84–3.96	42,000,000
10	4.00–4.69	34,330,000
3	.....	7,500,000
49		$787,562,300
Debentures (Av. yield 3.28%)		
6	2.75–4.50	$40,750,000
Notes		
2	3.00 and 3.25%	$2,480,000
2	.....	18,900,000
4		$21,380,000
Preferred Stock (Av. yield 4.48%)		
11	3.84–4.88	$128,463,200
5	5.10–6.55	5,331,300
16		$133,794,500
Common Stock		
2	.....	$5,972,520
Total Financing	.....	$989,459,320
Refunding	.....	897,082,940
New Capital	.....	92,376,380

Private placements were less than in 1939. Twenty-seven issues of bonds and one of preferred stock went to institutions. The total was $188,976,000, against $252,625,000 in 1939.

Refinancing provided large savings in debt service. Sixty per cent of the bonds sold on an interest basis of less than 3 per cent. Average interest of all bonds sold during the year was 3.04 per cent. Debentures averaged 3.28 per cent, notes between 3 and 3.25 per cent and preferred stocks 4.48 per cent.

SECURITY SALES BY CLASSES (in Thousands of Dollars)

Year	Bonds, Debentures, etc., to		Stocks, Common and Pfd.† (3)	Sales to Customers (4)	Total Financing† (5)	Allocation of Public Sales*		
	Public Investors (1)	Institutional Investors (2)				New Capital (6)	Refunding (7)	Total Issues (8)
1927.....	1,528,633		360,277	240,000	2,128,909	830,440	913,195	1,743,635
1928.....	922,098		549,399	170,000	1,641,498	599,809	637,412	1,237,220
1929.....	523,408	Included	792,051	145,000	1,460,459	624,174	257,602	881,776
1930.....	1,114,636	in	338,218	135,000	1,587,854	894,473	403,062	1,297,535
1931.....	1,090,584	Col. 1	258,658	159,000	1,508,242	424,163	758,741	1,182,904
1932.....	404,840		47,417	18,000	470,257	165,728	239,112	404,840
1933.....	53,725		2,148	375	56,248	6,813	46,913	53,725
1934.....	131,175		.....	.....	131,175	2,431	128,744	131,175
1935.....	957,042	110,629	8,229	.....	1,075,900	26,496	1,049,404	1,075,900
1936.....	1,122,800	156,881	52,259	.....	1,331,940	59,727	1,272,213	1,331,940
1937.....	522,613	37,604	86,095	.....	646,312	81,984	563,699	645,682
1938.....	750,549	192,762	20,694	.....	964,005	123,056	840,949	964,005
1939.....	620,205	252,625	123,517	.....	996,347	16,219	980,128	996,347
1940.....	660,716	188,976	139,767	.....	989,459	92,376	897,083	989,459

† Including rights and warrants. * Not including common stock rights and warrants.

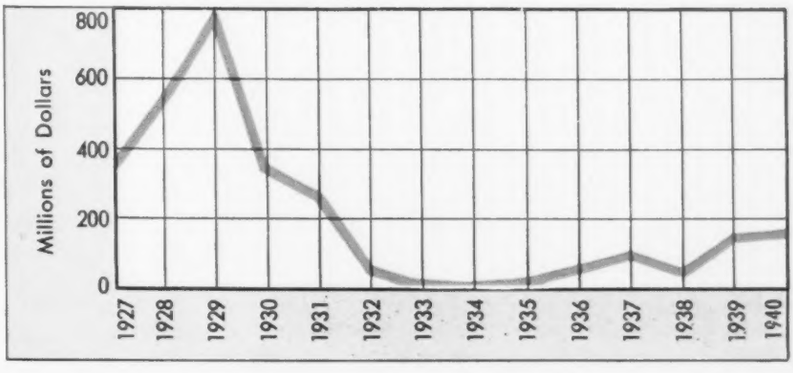
The outstanding issue of the year was 53 millions of 30-year 2¾ per cent refunding bonds of Boston Edison sold at 105 to yield 2.51 per cent. This is the lowest yield at which any utility issue has ever been sold.

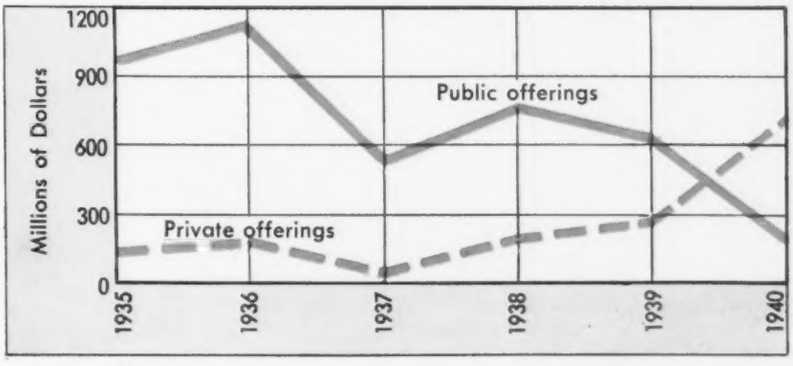
A market for common stocks was indicated. Indianapolis Power & Light started it off with 68,855 shares at 24 and West Penn Power followed with 160,000 shares at 27.

Stock prices (37 issues) had a high in January of 32.7. They slumped to a low of 26 when Hitler invaded the Low Countries in May and June, recovered a little and sold off toward the year end under 27.

Bond prices (50 issues) remained steady most of the year, dropping about 3 points in midsummer under war news and then recovering to close the year at near high.

TREND OF EQUITY FINANCING



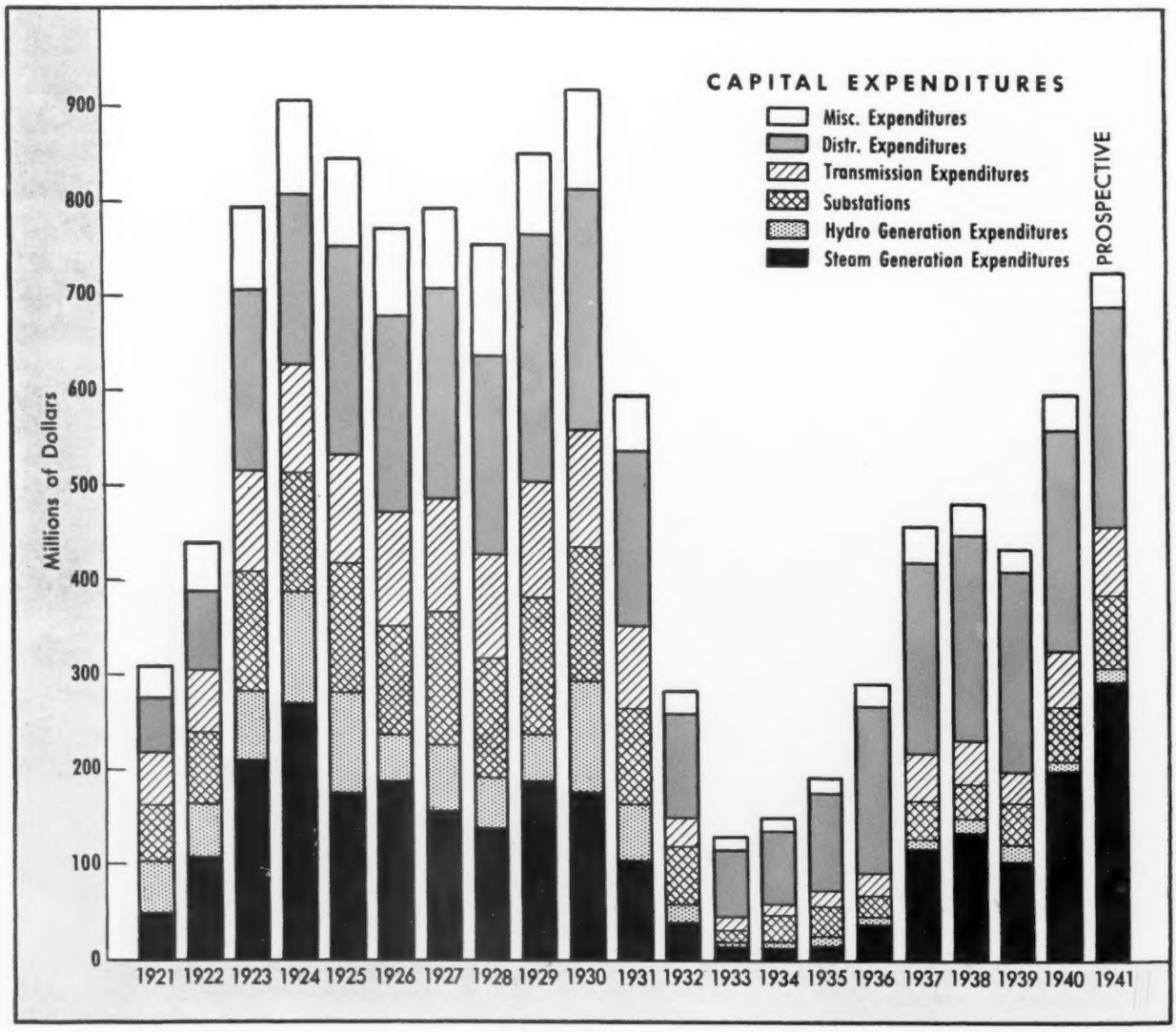


PUBLIC AND PRIVATE SECURITY OFFERINGS

BUDGET

PROPOSED CAPITAL EXPENDITURES in 1941, the largest since 1930, add up to $724,110,000. This is an increase of 127.5 millions, or 21.4 per cent. Forty-two per cent of this will go for new generating capacity, 53 per cent for transmission, distribution and substations and the remainder for miscellaneous.

Expenditures during 1940 were approximately the same in total as budgeted, but considerable switching was done in the several items. Less was spent on steam, hydro and transmission than budgeted, but considerably more on substations and distribution. Some of the steam was deferred until 1941.



CAPITAL EXPENDITURES

Electric Light and Power Industry

1939 Expenditures	
Generating stations	$119,400,000
Transmission, distribution, substations	287,750,000
Miscellaneous	22,850,000
Total	$430,000,000
1940 Expenditures	
Generating stations	$209,700,000
Transmission, distribution, substations	351,360,000
Miscellaneous	35,520,000
Total	$596,580,000
1941 Expenditures (prospective)	
Generating stations	$305,360,000
Transmission, distribution, substations	385,000,000
Miscellaneous	33,750,000
Total	$724,110,000

CAPITAL EXPENDITURES, 1940, BY REGIONS

(In Thousands of Dollars)

	Steam	Hydro	Transmission	Substations	Distribution	Miscellaneous	Total
Eastern	67,400	1,990	13,000	14,100	72,500	10,300	179,290
Central	89,400	1,520	16,500	21,500	81,000	12,800	222,720
Southern	35,200	1,360	10,400	12,700	48,600	5,860	114,120
Western	8,430	4,400	16,000	9,460	35,600	6,560	80,450
Total	200,430	9,270	55,900	57,760	237,700	35,520	596,580

PROSPECTIVE CAPITAL EXPENDITURES, 1941

Eastern	91,300	2,460	19,500	22,400	67,900	11,900	215,460
Central	133,000	1,720	26,800	30,600	78,900	12,500	283,520
Southern	50,800	1,350	15,700	16,400	53,400	4,730	142,380
Western	18,700	6,030	10,100	10,800	32,500	4,620	82,750
Total	293,800	11,560	72,100	80,200	232,700	33,750	724,110

A comparison of the proposed expenditures for 1941 shows with a few exceptions a greater activity in every item than in any year in the past decade. Steam expenditures are the largest in history. Transmission is up nearly 30 per cent over last year, while substations (up 39 per cent) show the preparations for defense. Distribution is off about 2 per cent. Most systems reported increases in the 1941 distribution budget, but two or three large systems that had been engaging in a major program for the past three years reported large decreases.

These figures are for private and municipal. They do not include federal expenditures.

ANNUAL CAPITAL EXPENDITURES FOR NEW CONSTRUCTION

Electric Light and Power Industry (In Thousands of Dollars)

	Steam	Hydro	Transmission	Substations	Distribution	Miscellaneous	Total
1921	49,858	52,816	60,657	52,000	59,077	35,000	309,908
1924	269,700	109,540	134,190	114,000	179,010	101,000	907,440
1927	156,000	69,000	141,000	119,000	220,000	89,000	794,000
1928	137,000	56,000	125,000	107,000	212,000	117,000	754,000
1929	188,000	51,000	145,000	120,000	261,000	88,000	853,000
1930	176,496	117,565	139,533	123,482	258,699	103,642	919,417
1931	104,386	60,317	101,031	87,564	182,158	61,284	596,740
1932	40,000	20,000	60,000	30,000	110,000	25,000	285,000
1933	10,400	4,000	16,100	14,900	72,200	11,700	129,300
1934	10,258	5,704	30,180	11,921	76,299	13,292	147,654
1935	16,172	6,337	35,349	14,766	103,104	17,127	192,855
1936	36,820	9,030	20,170	25,050	174,640	24,000	289,710
1937	113,060	10,540	40,740	49,290	203,250	38,600	455,480
1938	133,000	17,600	36,000	46,400	215,000	34,000	482,000
1939	101,500	17,900	45,500	31,750	210,500	22,850	430,000
1940	200,430	9,270	55,900	57,760	237,700	35,520	596,580
1941†	293,800	11,560	72,100	80,200	232,700	33,750	724,110

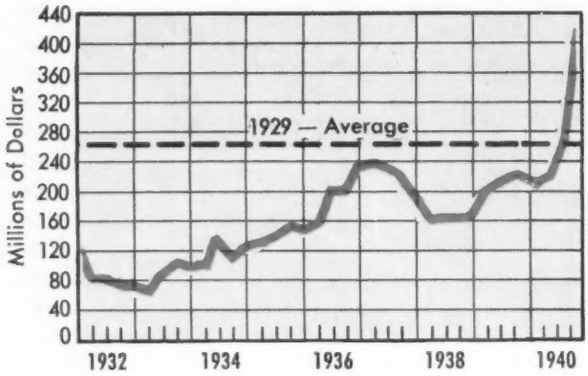
† Prospective.

MANUFACTURING

SALES of electrical apparatus, supplies and appliances on the basis of census classification aggregated last year $1,800,000,000, an increase of 25.2 per cent over 1939. This was but slightly below the peak of 1929.

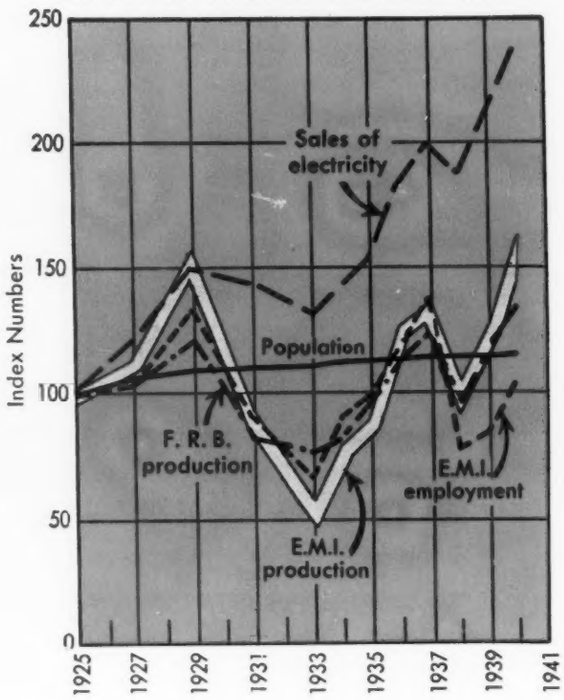
ELECTRICAL GOODS

New Orders Booked Quarterly by 78 Manufacturers

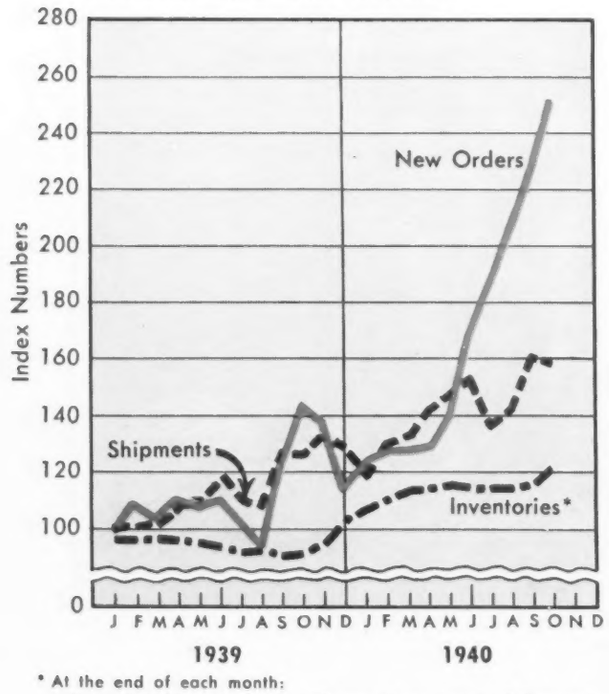


Source: Department of Commerce

ELECTRICITY SALES AND MANUFACTURING ACTIVITIES



ELECTRICAL MACHINERY



* At the end of each month: Dec. 31, 1938 equals 100

Source: Department of Commerce

Index of electrical goods sales increased twice as fast as general business—25.2 per cent as against 12.6 per cent.

Bookings for the third quarter were the largest in history, being half again as large as 1929 average. Fourth quarter bookings were probably even larger.

From October to October sales were up 70 per cent and shipments 25 per cent, indicating a record backlog as the year opens. During the same period inventories increased 32.5 per cent.

ELECTRICAL MANUFACTURING INDUSTRY AND RELATED FACTORS

Index Numbers 1925 = 100

	1927	1929	1931	1933	1934	1935	1936	1937	1938	1939	1940*
1. E. M. I. production	112	156	85	51	70	85	119	137	97	123	154
2. E. M. I. employment	101	137	90	68	88	94	106	128	77	84	104
3. F. R. B. production	104	121	82	76	82	96	113	124	97	119	134
4. Sales of electricity	122	150	144	131	141	155	180	199	187	212	227
5. Population	103	106	108	109	110	111	112	113	113	114	115

Source: N.E.M.A. *Estimated.

NOTES

1. E.M.I. PRODUCTION based on U. S. Census of Manufactures and data compiled by N.E.M.A. statistical department. In addition to products shown in electrical machinery apparatus and supplies schedule of the Census there are included electric refrigeration, radio apparatus and supplies, steam turbines for electrical drive, electrical porcelain, glass insulators and electric washing machines.

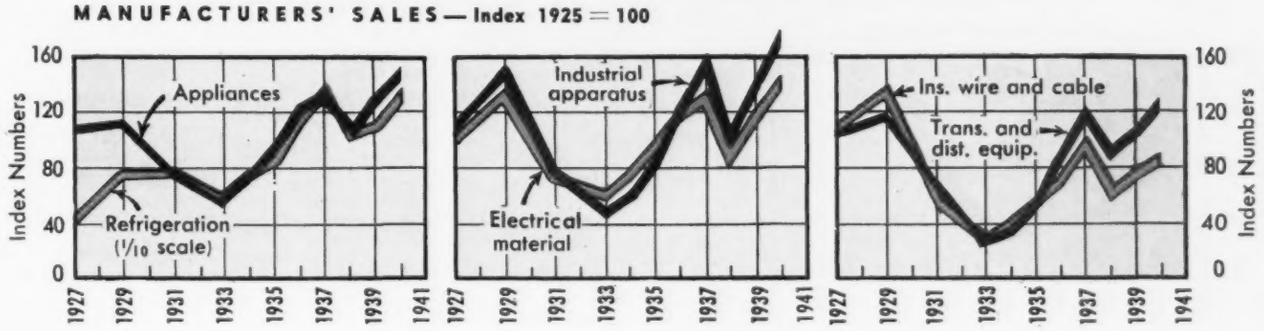
2. E.M.I. EMPLOYMENT based on labor series of National Industrial Conference Board, but adjusted to 1925 = 100. This series represents the electrica manufacturing industry including radio.

3. F.R.B. PRODUCTION based on the Federal Reserve Board's revised index for the manufacturing industry and adjusted to 1925 = 100. (Entire series revised in 1940.)

4. ELECTRIC POWER SALES index figures based upon Edison Electric Institute data.

5. POPULATION based upon the annual midyear estates of the U. S. Bureau of the Census.

MANUFACTURERS' SALES — Index 1925 = 100



Radical price reductions in refrigerators were apparently justified, for the unit sales rebounded to within 20 per cent of the peak year. Other appliances had a record year, as did industrial appliances. T and D equipment was approximately the same as 1937, the previous peak. Insulated wire and cable sales were up 15.5 per cent, but were still 40 per cent below 1929.

SOME MAJOR BRANCHES OF THE ELECTRICAL MANUFACTURING INDUSTRY

Index Numbers 1925 = 100

	Manufacturers' Sales	1927	1929	1931	1933	1934	1935	1936	1937	1938	1939	1940*
1. Appliances	100 = $140,000,000	106	110	72	57	73	92	121	136	109	128	148
2. Refrigeration	100 = 16,000,000	425	766	778	574	747	844	1,131	1,360	769	1,100	1,351
3. Electrical material	100 = 38,000,000	100	135	71	59	74	93	116	131	83	116	142
4. Industrial apparatus	100 = 132,000,000	105	149	75	47	59	83	118	161	97	127	177
5. Trans. and dist. equip.	100 = 167,000,000	106	120	64	22	33	50	83	124	90	104	123
6. Ins. wire and cable	100 = 110,000,000	106	133	54	27	36	46	69	98	60	71	82

Source: N.E.M.A. *Estimated.

1. APPLIANCES include domestic kitchen and table appliances, electric ranges, electric water heaters, electric vacuum cleaners, electric washing machines, electric fans and food service equipment.

2. HOUSEHOLD REFRIGERATION includes complete units, parts and cabinets. Commercial refrigeration equipment and air-conditioning equipment are excluded. These index figures appear unusually large because the household refrigeration industry was just beginning about 1925 and therefore the base figure is small.

3. ELECTRICAL MATERIAL includes carbon, electrical porcelain, laminated phenolic products, manufactured electrical mica and vulcanized fiber. Molded insulation is excluded.

4. INDUSTRIAL APPARATUS includes electric welding equipment and wire, industrial controls, industrial heating equipment and motors and generators (excluding all generators except motor-generator sets). Electric furnaces and electric tools are excluded.

5. TRANSMISSION AND DISTRIBUTION EQUIPMENT includes switchgear, high-voltage insulators, power and distribution transformers, lightning arresters, pole line hardware and earth anchors, panelboards and distribution boards, small air circuit breakers and electrical measuring instruments.

6. INSULATED WIRE AND CABLE for light and power includes wire and cable of various types of insulation such as paper, rubber, varnished cambric and weatherproof used primarily for lighting and power circuits and lines. Bare wire is excluded.

All indices based upon U. S. Census of Manufactures data and N.E.M.A. statistical department data corrected where possible to represent the entire industry.

REA OPERATION

HERE IS PRESENTED the beginning of what is intended to be a regularly continuing feature of the annual statistical number of ELECTRICAL WORLD—REA operating data.

The figures here given are insufficient for a comprehensive picture because in the short time between request for data and publication deadline REA was unable to assemble all of the desired figures. With continuance of the willing co-operation already demonstrated by REA in supplying the present data, it is expected that the statistics of federal promotion of rural service will be much more complete next year.

An important value of total figures on any large operation is that from them there may be derived unit quantities easy of statement and of grasp.

From the present figures it is to be calculated that, as of 1940, there were in REA operating systems averages of 370 miles of line per system, 2.43 consumers per mile of line and $372 of funds advanced per consumer.

Use of energy per consumer and price paid per unit of energy are impossible to compute rigorously because the data include no figures on energy sales nor on revenue.

But by using previously stated figures it is possible to reach expressions for energy sales, for revenue and for operating expenditures.

In an address before the American Society of Agricultural Engineers, M. M. Samuels, REA chief research engineer, used 25 per cent as the loss in energy between system input and consumers. On this basis it appears that as of 1940, 330,333,120 kw.-hr. were sold to consumers, an average of 581 kw.-hr. per year, or 48.4 kw.-hr. per month per consumer.

Harry Slattery, REA Administrator, estimated in his book, "Rural America Lights Up" (page 86), that a typical "3-to-the-mile" farmer using 100 kw.-hr. per month will pay 4½ cents per unit of energy. Combining this estimate (rather unjustifiably, since the average consumer apparently uses less than 50 kw.-hr. per month) with the figure of 330,333,120 kw.-hr. sold, as calculated in the preceding paragraph, the sum of $14,864,990 is reached as annual revenue.

Some of the annual income must be used to pay operating expenses. According to the calculation in Mr. Slattery's book, two-thirds of the monthly bill paid by the typical "3-to-the-mile" farmer is needed for operating expenditures. By applying this ratio to the derived figure of income there results the sum of $9,909,994 to be stated as operating expenditures.

RURAL ELECTRIFICATION ADMINISTRATION

Financial and Operating Statistics —Fiscal Years, 1936 to 1940, Incl.

ITEM	FISCAL YEAR				
	1936	1937	1938	1939	1940
Funds advanced	$823,262	$11,041,578	$48,175,974	$62,297,014	$98,949,463
Number of REA operating systems [1]	11	45	248	417	630
Miles of line in operation [1]	†400	†8,000	†40,000	†115,000	233,166
Consumers receiving electric service [1]	693	19,611	104,528	268,242	567,998
Energy generated by cooperatives (net kw.-hr.)	*	*	*	†26,058,000	34,971,891
Energy purchased by cooperatives and power districts (kw.-hr.)	*	*	*	152,379,885	405,472,269
Generating plants, number in operation	*	*	*	20	[3] 32
Generating plants, total capacity, kw. [2]	*	*	*	19,427	[3] 26,199

* Not available. † Estimated. [1] As of June 30. [2] As of December 10. [3] Excludes capacity under construction.

OUTSTANDING FACTS

	1930	1932	1934	1936	1937	1938	1939	1940*
FIXED CAPITAL ($1,000)	11,800,000	12,664,377	.....	.....	12,940,993	†13,003,000	†13,011,000	†13,057,000
Securities issued [1]	1,587,854	470,257	131,175	1,331,940	646,312	964,005	996,347	989,459
New capital	894,473	165,728	2,431	59,727	81,984	123,056	16,219	92,376
Refunding	403,062	239,112	128,744	1,272,213	563,699	840,949	980,128	897,083
REVENUE [2] ($1,000)								
From ult. consumers	1,990,955	1,813,717	1,831,871	2,044,587	2,160,798	2,156,580	2,289,583	2,413,234
Farm	46,690	47,128	49,183	59,286	37,726	38,928	45,484	49,674
Residential	642,276	640,385	648,802	696,997	759,824	802,532	843,158	885,900
Small light and power	575,598	500,993	490,420	562,122	616,438	632,091	660,683	684,740
Large power and light	566,468	474,425	499,452	581,149	583,197	518,694	572,659	621,890
Other consumers	159,922	150,786	144,013	145,032	163,611	164,334	167,597	171,030
EXPENDITURES ($1,000)								
Capital	919,417	285,000	147,654	289,710	455,480	482,000	430,000	596,580
Operating, total	.....	817,950	.....	.....	1,027,588	.....	.....	.....
Salaries and wages	423,000	323,880	316,000	360,000	470,353	460,000	469,500	488,000
PRIVATE COMPANIES ($1,000)								
Operating revenue	.....	1,719,000	1,736,000	1,941,000	2,050,000	2,035,000	2,141,000	2,265,000
Operating expenses	.....	616,000	636,000	725,000	790,000	772,000	802,000	850,000
Taxes	.....	205,000	243,000	286,000	312,000	330,000	340,000	405,000
OUTPUT [3] (1,000,000 kw.-hr.)								
Generated	94,652	82,377	90,806	112,181	121,837	116,681	130,336	144,600
From steam	62,278	48,457	56,451	71,756	76,330	70,727	85,007	97,300
From water power	31,738	33,322	33,713	39,516	44,489	44,834	44,021	47,300
From internal combustion	636	598	642	909	1,018	1,120	1,307	.....
CAPACITY [3] (1,000 kw.)								
Generator ratings	34,055	35,991	35,791	36,564	37,134	39,042	40,318	41,661
Steam	24,696	25,474	25,524	25,519	25,873	27,203	28,047	29,009
Hydro	8,941	9,583	9,742	10,436	10,576	11,066	11,415	11,726
Internal combustion	418	487	525	609	685	773	856	926
FUEL CONSUMPTION [3]								
Coal and coke (1,000 short tons)	42,910	30,296	33,561	42,025	44,766	40,212	46,223	52,780
Oil (1,000 bbl.)	9,263	7,967	10,391	14,119	14,143	13,077	17,423	16,790
Gas (billion cu. ft.)	120	108	128	156	171	171	191	184
ENERGY SALES [3] (1,000,000 kw.-hr.)								
Ult. consumers	74,906	63,711	71,082	90,044	99,359	93,731	105,768	118,487
Farm	1,789	1,579	1,857	2,138	1,670	1,577	1,881	2,014
Residential	10,703	11,494	12,233	14,992	17,691	19,371	21,084	23,230
Small light and power	13,944	12,106	12,278	15,612	18,075	19,137	20,722	22,239
Large power and light	40,148	30,964	36,944	48,655	51,360	43,140	51,108	59,560
Other	8,322	7,568	7,770	8,647	10,562	10,505	10,972	11,444
CUSTOMERS [3] (1,000)								
Total number	24,556	23,878	24,663	26,206	27,262	28,064	29,105	30,091
Farm	650	709	744	1,043	519	526	634	686
Residential	19,880	19,140	19,866	20,988	22,372	23,112	23,965	24,851
Small light and power	3,626	3,604	3,670	3,825	4,072	4,127	4,215	4,260
Large power and light	347	371	324	280	197	192	184	182
Other	53	54	59	70	102	107	106	113
People in electric lighted homes	83,400,000	82,500,000	84,500,000	90,000,000	98,500,000	101,500,000	106,000,000	110,000,000
Per cent of total population	68.2	67.0	67.1	70.3	76	78	81	84
EMPLOYEES, total	298,000	244,573	247,000	268,000	279,000	270,000	269,000	275,000

* Estimated, generally on ten months' operations. [1] Includes warrants and rights. [2] Revised figures beginning with 1937 conform to Uniform System of Accounts. [3] Includes other electric, in addition to light and power. † Electrical World Estimate.

CHRONOLOGY OF 1940

JANUARY

Duquesne Light announces $16,000,000 construction program for 1940, including 80,000-hp. generating unit at James H. Reed station.

Leland Olds elected chairman of Federal Power Commission.

TVA issues report for fiscal year ended June 30, 1939.

Public Service Corp. of N. J. authorizes $17,500,000 budget, including 100,000-kw. unit at Burlington.

W. A. Jones elected president of Cities Service Co., to succeed the late Henry L. Doherty.

Associated Gas & Electric Co. files bankruptcy petition.

In his first formal appearance as president of the General Electric Co., Charles E. Wilson forecasts era of sound expansion for electrical industry even greater than the 1920s.

Louis H. Egan, former president and Frank J. Boehm, former executive vice-president of Union Electric Co., sever all connections with company.

Connecticut utilities release plant expansion budget figures, approximating $8,200,000 for 1940. United Illuminating Co. to add new 25,000-kw. unit.

Northern States Power Co. announces $10,441,500 budget, the largest in ten years.

A.I.E.E. meets in New York. Philip Torchio, former Consolidated Edison vice-president, receives Edison Medal.

North American Co. announces expansion program to cost $61,000,000; $38,500,000 scheduled for 1940.

American Gas & Electric integration hearings open before SEC.

FEBRUARY

N.E.M.A. holds midwinter convention in New York. Huntington B. Crouse, president of Crouse-Hinds Co., receives James H. McGraw Award Manufacturers Medal.

Alfred C. Marshall succeeds Alex Dow as president of Detroit Edison Co. Dow becomes chairman of executive committee.

Iowa Electric Light & Power Co. orders 15,000-kw. unit for Cedar Rapids plant from General Electric Co.

Southern California Edison Co. announces plans for $2,675,000 expenditure on distribution system.

Wisconsin Electric Power Co. announces plans for expenditure of $3,500,000 for system expansion and modernization.

James H. Polhemus succeeds Franklin T. Griffith as president of Portland General Electric Co. Griffith becomes board chairman.

Middle West Corp. issues plans for expenditure of $17,920,000, an increase of 45 per cent over 1939.

Alabama Power Co.'s $6,065,273 budget includes new 40,000-kw. steam station at Mobile.

R. W. Sorenson nominated for A.I.E.E. presidency.

Puget Sound Power & Light Co. places new budget at $2,427,098.

Roger J. Whiteford resigns as president of Associated Gas & Electric Co.

Louisville Gas & Electric Co. directors authorize construction of 25,000-kw. addition to Canal station.

SEC sets hearing dates for systems integrations. Electric Bond & Share and Engineers Public Service first cited.

Virginia Public Service Co. starts new steam plant at Alexandria.

Private and municipal electric systems in Far West places construction budget at $80,000,000.

TVA reaches agreement with Alabama Power Co. for purchase of electric properties in northern Alabama—price $4,600,000.

Tacoma and Bonneville make ten-year agreement for interconnection.

Davenport utilities file merger plans with SEC.

MARCH

Ice storm strikes New York, New Jersey, Pennsylvania, Connecticut and other parts of New England.

Court appoints three trustees for Associated Gas & Electric System.

SEC notifies Middle West Corp., United Gas Improvement Co., Cities Service Power & Light Co. to begin integration.

New York State industries oppose St. Lawrence project at meeting held under the auspices of the New York State Waterways Association.

U. S. Supreme Court refuses to review Duke Power-Greenwood County case.

Commissioner Robert E. Healy out as sponsor of SEC utility division.

U. S. Supreme Court agrees to review Appalachian Electric Power-New River case.

Standard Power & Light, Commonwealth & Southern, North American and United Light & Power notified by SEC to make known plans of integration.

Gov. Phillips of Oklahoma orders National Guard to block government completion of $20,000,000 dam on Grand River.

Kansas City Power & Light announces construction budget of $3,788,516; includes 50,000-kva. turbo-generator for Northeast station.

Pennsylvania Power & Light Co. issues plans for expenditure of $5,000,000 on new construction; includes 15,000-kw. unit for Cedar station at Harrisburg.

Expenditures on government power activities will total approximately $139,921,375 for 1941 fiscal year.

Westinghouse tests new circuit breaker.

Wahkiakum County (Wash.) buys West Coast Power Co. lines for $120,000.

Philadelphia Electric Co. plans construction expenditure of $15,301,000; new 50,000 kw. unit to go in Chester station.

Plans for Power Grid discussed at New York meeting attended by government officials and utility executives; network to cost $200,000,000; FPC Chairman Leland Olds discusses project with President Roosevelt.

Los Angeles plans to build 100,000-kw. plant.

Public Service Co. of Indiana announces $6,869,026 construction budget, including

new 50,000-kw. General Electric unit at Dresser station.

Fluorescent lighting conference held in Chicago, principles adopted by E.E.I. general sales committee presented.

George C. Mathews quits SEC to join Northern States Power Co.

New rural lines a feature of $1,303,000 construction budget announced by the Utah Power & Light Co.

APRIL

New trend in utility financing gets under way with common stock offering of Indianapolis Power & Light Co.

Commonwealth Edison announces $100,000,000 construction program to cover three-year period.

Toledo Edison plans 50,000-kw. turbo-generator installation at Acme plant to cost $4,500,000.

Indianapolis Power & Light Co. starts work on 35,000-kw. addition to Harding Street station.

Public Service Co. of Northern Illinois authorizes 25,000-kw. unit for Joliet station.

U.G.I. system units to spend $20,000,000 in 1940, Zimmermann tells stockholders.

Jerome N. Frank, SEC chairman, sees integration aiding utility industry.

Engineers Public Service Co. opposes "dismemberment" of system.

El Paso Electric Co. signs twenty-year contract with Bureau of Reclamation for distribution of Elephant Butte power.

N. Y. State Power Authority urges development of St. Lawrence and Niagara Rivers power resources in annual report to Governor and Legislature.

TVA announces plans for installation of two 35,000-hp. generating units in Wilson Dam power house.

U. S. Supreme Court ends Hetch-Hetchy power sales via Pacific Gas & Electric Co.

Former officers of Associated Electric Co. replaced.

Union Electric Co. of Illinois plans new steam plant at Venice.

Bonneville sells second block of 32,500 kw. of power to Aluminum Co. of America.

MAY

Southeastern Electric Exchange meets in Roanoke, Va. A. W. Higgins elected president.

I.E.S. initiates plan to establish regional conferences with Los Angeles meeting.

John E. Zimmermann elected chairman of the board of the Philadelphia Electric Co., succeeding William H. Taylor, resigned.

TVA announces plans for four units at two hydro plants.

Commonwealth & Southern and Electric Bond & Share challenge legality of Utility Act. Charge SEC with failure to set standards for integration.

North American Co. named respondent in SEC case against its subsidiary, Union Electric Co. of Missouri.

New York World's Fair of 1940 opens.

Hopson and three aids indicted by grand jury.

New 105,000-kw. turbo-generator at Powerton station of Commonwealth Edison put in operation.

Alabama Power Co. completes sale of its facilities in north Alabama to TVA, municipalities and co-operatives.

NEMA holds spring conference in Hot Springs, Va.

San Francisco Exposition opens.

JUNE

Edison Electric Institute holds convention in Atlantic City. Industry supports national defense plans.

Central Illinois Public Service Co. announces plans to install second 25,000-kw. unit at new Hutsonville steam station.

New flood control bill introduced in the House. Lists four power purpose projects in $191,000,000 authorization sought in measure. Georgia, Texas, Arkansas and Missouri.

Paul J. Raver, Bonneville administrator, recommends integration of all power facilities in the Pacific Northwest.

Senate agrees to $60,000,000 increase in REA funds voted by House in annual farm appropriation.

Electric Bond & Share asks SEC to defer integration proceedings in interest of national defense program.

Stettinius appoints advisory defense commission to co-ordinate electric power supply. Gano Dunn made chairman.

Consumers Power Co. dedicates John C. Weadock steam-generating station at Bay City, Mich.

Virginia Public Service Co. completes installation of new 70,000-lb.-per-hour boiler in $170,000 program. New 15,000-kw. addition under way at Alexandria.

Georgia Power Co. plans immediate construction of a $3,600,000 addition to Atkinson steam-generating station near Atlanta.

National Defense gets support at A.I.E.E. summer convention at Swampscott, Mass.

G. M. Gadsby, president, Utah Power & Light Co., announces plans for power grid for five-state loop.

President Walter S. Wyman of Central Maine Power Co. announces purchase of 20,000-kw. steam turbine unit for 1941 delivery.

War problems discussed by Canadian Electrical Association at annual convention. G. A. Gaherty elected president.

Central Illinois Public Service Co. places new 25,000-kw. unit in service at Hutsonville station.

FPC approves plans of Nantahala Power & Light Co. for two hydro projects.

Wendell L. Willkie receives Republican nomination for the presidency of the United States.

JULY

Duke Power Co. places in operation the 100,000-hp. steam plant at Cliffside.

Kansas City Power & Light Co. puts 35,000-kw. unit at Northeast station on line.

Georgia Power Co. orders 60,000-kw. turbo-generator to be installed next year in Atkinson Plant at Atlanta.

Westinghouse Electric & Manufacturing Co. organizes for defense production. Board Chairman Robertson presents survey of company's war facilities to Roosevelt and Knudsen.

North American Co. prepares for defense peak loads. Increased program of power plant construction calls for 110,000 kw. over and above 270,000-kw. of additions announced in January.

Illuminating Engineering Society elects A. D. Cameron, Holophane vice-president, president.

Jerome N. Frank re-elected chairman Securities & Exchange Commission.

Justin R. Whiting succeeds Willkie in utility posts.

Detroit Edison Co. orders 75,000-kw. turbo-generator for Delray station.

Bonneville completes unit of major substation. Plant to serve as supply depot for western half of project.

SEC rejects national defense as a ground for withholding application of death sentence in public utility holding companies.

Wisconsin Electric Power Co. starts work on $7,000,000 addition to Port Washington plant. Will double the present capacity; 80,000-kw. steam turbo-generator to be installed.

General Electric Co. reports turbine business hits all-time peak.

Congress appropriates $25,000,000 for TVA.

Central Power & Light Co. to double capacity of Nueces Bay power plant.

E. F. Scattergood retires as general manager and chief electrical engineer of Los Angeles Bureau of Power and Light. H. C. Gardett appointed successor.

AUGUST

Philadelphia Electric Co. orders 80,000 kw. low-pressure condensing unit for Chester station. Expands its grid.

Top men in Associated Gas & Electric system replaced.

Los Angeles Bureau of Power & Light places contract for 65,000-kw. turbo-generator.

Puget Sound Power & Light granted by court right to severance damages. $5,000,000 set as value of facilities sought by P.U.D.

Nebraska TVAs ordered to pool operations.

Virginia utilities join in $6,000,000 expansion. New transmission line to connect systems of Virginia Electric & Power Co. and Virginia Public Service Co.

President Whiting reports Commonwealth & Southern operating subsidiaries organized to meet power needs. Companies are adding 290,000-kw. of generating capacity.

Flood in South causes large property damage.

Roosevelt names Raver power marketing agent. Executive order consolidates sale and distribution of power from Bonneville and Grand Coulee dams.

Bernard W. Lynch resigns as president of Standard Gas & Electric Co. Leo T. Crowley succeeds him.

Work starts on new 60,000-kw. turbo-gen-

erator at Windsor plant of West Penn Power Co.

Public Service Electric & Gas Co. orders 100,000-kw. unit for Burlington station.

Wisconsin utilities plan interchange power pact.

SEPTEMBER

President Roosevelt dedicates Chickamauga Dam.

Connecticut Power Co. announces plans for new 25,000-kw. steam turbine at Stamford.

Pennsylvania Electric Association meets at Bedford Springs.

Atlantic City Electric Co. plans 25,000-kw. unit for Missouri Avenue station.

Consolidated Edison Co. of New York orders 50,000-kw. hydrogen-cooled superposed turbine-generator to be installed in Sherman Creek station.

Purge hits Los Angeles Bureau of Power & Light. Scattergood pensioned, 170 to 200 employees dismissed.

REA advances schedule for building 92,000 miles of lines.

Illuminating Engineering Society meets at Spring Lake.

Rocky Mountain Electrical League holds annual meeting at Albuquerque. Gaylord B. Buck elected president.

City of Plattsburg reaches tentative agreement with New York State Electric & Gas Co. for purchase of facilities.

Construction of giant Intermountain-Northwest power grid begins.

New 25,000-kw. turbine at Bayside plant of Wisconsin Public Service Co., authorized by state Public Service Commission.

R. B. MacDonald, president of United Light & Power Co., announces expansion program in Moline involving $2,000,000.

Wisconsin Electric Power Co. breaks ground for addition to Port Washington station.

Connecticut Light & Power Co. plans expenditure of $4,000,000 for expansion, including 43,000-kva. unit for Devon plant.

Irving K. Peck elected president of Empire State Gas and Electric Association at annual convention.

OCTOBER

Boston Edison orders two steam turbo-generators, aggregating 58,000 kw. Comerford announces new expenditures totaling $13,000,000 for Boston Edison and Narragansett Electric Co., unit of New England Power Association.

General Electric Co. plans $50,000,000 expansion.

Cincinnati Gas & Electric Co. places order for 65,000-kw. turbo-generator.

New plan for St. Lawrence project gets under way.

Northern Indiana Power Co. builds new 66,000-volt line, connecting the system with that of Indiana & Michigan Electric Co.

Westinghouse Electric & Manufacturing Co. plans expansion of plants.

Aluminum Co. of America plans three additional units to plant at Bonneville. Nantahala Power & Light Co., Aluminum subsidiary, files declaration of intent to construct 300,000-hp. hydro-electric project on Little Tennessee River near Fontana, Tenn.

President Roosevelt allocates $1,000,000 for the St. Lawrence project. Defense fund used.

Consumers Public Power District completes arrangements to buy for $1,100,000 Southern Nebraska Power Co.

Florida Power & Light Co. announces plans for $2,500,000 generating plant; 30,000-kw. extension proposed.

TVA to make explosives for Army's defense plan.

Buffalo Niagara Electric Corp. will add 80,000-kw. generating capacity to Charles R. Huntley steam station at Buffalo.

United States and Canada appoint St. Lawrence boards. Leland Olds chairman of American group.

President Roosevelt sets up priorities board.

N.E.M.A. meets in New York. E. O. Shreve elected president. George A. Hughes wins McGraw Award.

NOVEMBER

President Roosevelt re-elected.

Pacific Northwest votes on public ownership. Washington rejects Initiative 139. Oregon voters split.

St. Lawrence committees meet and map out preliminary program for construction of hydro-electric power development.

Consolidated Gas, Electric Light & Power Co. of Baltimore installs 25,000-kw. generator, the first of its type to be put into operation, at Westport station.

Commonwealth Edison Co. puts in service new 147-mile, 220,000-volt transmission line from Powerton to Crawford stations.

Drastic reforms needed in utility industry, Leo T. Crowley tells Wisconsin Utilities Association meeting in Milwaukee. Floating power plants discussed by A. P. Kellogg of General Electric turbine division.

Standard Power & Light Corp. files plan with SEC to divest itself of control over Standard Gas & Electric Co.

Kentucky Utilities Co. plans new steam-electric generating plant on Kentucky River near Tyrone, with initial capacity of 25,000-kw., costing $3,000,000.

General Electric Co. announces completely new design of line of general purpose polyphase induction motors—one of the most extensive product changes in the company's history.

Pacific Gas & Electric Co. completing three plants. Construction expenditures this year total $26,000,000.

Wisconsin Public Service Corp. directors approve construction budget for 1941 of $4,478,000, the largest in the corporation's history.

FPC conducts inquiry into opposition to P.U.D. movement in Northwest.

Central Maine Power Co. starts construction of new 27,000-hp. steam-electric generating plant.

Virginia Public Service Co. plans 15,000-kw. addition to Alexandria station, to be installed in 1942. Puts 15,000-kw. unit in operation.

FBI makes inquiry to prevent sabotage.

Niagara Frontier celebrates fiftieth anniversary of the development of hydro-electric power at Niagara Falls.

Pacific Gas & Electric Co. announces plans for new $3,210,000 hydro-electric generating plant near Dutch Flat.

Indianapolis Power & Light Co. markets preferred stock at $107.50.

General Electric employees get $8,000,000 bonus.

DECEMBER

Grand River Dam completed. Ready to meet power contracts.

Freak storm hits Texas Panhandle. Amarillo storm center. Fourteen private utility companies aid Southwestern Public Service Co. restore electric service.

National Exposition of Power and Mechanical Engineering opens in New York.

Danbury, Conn., rejects municipal ownership.

S. R. Inch resigns as president of Electric Bond & Share Co. Continues as head of Ebasco Services, Inc.

Nantahala Power & Light Co. asks FPC rehearing on Fontana plan.

FPC makes first of a series of monthly reports on availability of electric power. Forecastes of possible shortage viewed as unfounded by utilities.

Pennsylvania Power & Light Co. plans $5,000,000 expansion program at steam electric generating station at Hauto, near Mauch Chunk. Includes 35,000-kw. unit.

Union Electric Co. of Illinois will install third unit at Venice, an 80,000-kw. addition.

REA reorganizes administrative set-up.

Ohio Edison Co. places in operation new 35,000-kw. generator at Toronto plant.

Ickes agrees to new Hetch-Hetchy plan.

Cowlitz public utility district takes over electric facilities of Washington Gas & Electric Co.

Court upholds dismissal of Morgan as TVA head.

Supreme Court extends U. S. power over rivers in New River decision.

SEC makes inquiry into E.E.I. affairs.

North American System expands plant capacity. Original 1940-41 program doubled within last six months to meet national defense plans. President Shea informs the defense committee that power needs will be met.

Duke Power Co. will build 40,000-kw. addition to Buck steam power station, to be ready for operation in 1942.

New proposal made for system-wide acquisition of properties of Puget Sound Power & Light and Pacific Power & Light properties.

FPC terminates probe of alleged political activities and expenditures of five Pacific Northwest electric utilities.

Consumers Public Power District of Nebraska purchases northeastern Nebraska properties of Interstate Power Co. for $2,600,000.

Standard Gas & Electric Co. announces $53,807,000 construction budget for system in 1941.

Ohio Edison Co. plans to install new 35,000 kw. turbo-generator in new building at the Gorge power plant.

Hopson convicted. Found guilty on 17 counts, cleared of conspiracy. Travis and Brownback acquitted.

Retrospect

A review of trends in the electrical industry developed during the past year

S. B. WILLIAMS
Editor "Electrical World"

NATIONAL DEFENSE PREPARATION was without question the most dominating factor in 1940 business. It was slow in getting under way, but by fall its influence on all production was plainly evident in the fast rising curve of weekly output of electrical energy.

For the first time in several years the output each week exceeded the production of the same week of the previous year, going to the record high of almost three billion kw.-hr. in the third week in December. An indication of the extent to which load has grown is revealed by the July 4 week, the smallest output during the year, which was 20 per cent more than the peak week of 1929. Incidentally the 1940 peak week was 60 per cent greater than the 1929 peak.

Starting with October, the curve for weekly output of electrical energy has risen faster than at any time in the past decade with the result that the increase in output for 1940 was the largest number of kilowatt-hours for any single year. The total output for 1940 reached 144.6 billion kw.-hr.

New Capacity

Two years ago the utilities began to prepare for an anticipated war and defense demand, with the result that last year 1,850,000 kw. of new capacity was added and 4 million kw. scheduled for installation this year. The total new capacity placed in operation in 1940 and on order for 1941 and future years reaches a total of 9½ million kw.

The influence of expanding industrial production and double shift operation is indicated in the average hours of use of fuel capacity, which exceeded for the first time 3,000 hours per year.

While the industrial load dominated the new-business trend of last year, there were significant gains in other classes of business. Residential, with nearly a million new customers, increased the average use per customer to 952 kw.-hr. Another important gain was in street lighting, with an increase of 7 per cent, showing once more a definitely upward trend.

Expenses for operations increased proportionately with income, as indicated by the fairly stable operating ratio before taxes of 37.5 per cent. Taxes, on the other hand, increased almost twice as much as the increase in any previous year, rising to a figure of approximately 18 cents out of every dollar of income.

Expenditures for new construction were close to 600 million in 1940. An increase of 21 per cent to 724 millions is budgeted for 1941. This is the largest construction budget since 1930.

Considerably less new financing was undertaken than would be indicated by the construction expenditures. Out of a total of almost a billion financing in the year slightly less than 10 per cent was for new capital.

Manufacturing

The increased capital expenditures, as well as the demands of industry and increased employment, produced a volume of business for electrical manufacturers but slightly under that of the peak year of 1929. In the last half of the year equipment sales outstripped those of any previous six-month period, with the result that manufacturers enter 1941 with the largest backlog of orders in history. Electrical exports increased some 27 per cent in 1940.

Intimations of priorities were heard of from time to time, but manufacturers have found it possible to maintain service to normal as well as defense business. Turbine manufacturers, as a result of enormously increased naval business, have expanded plant facilities to take care of this situation.

Commercial

The effect of new low prices and increased employment were seen in the sales of appliances. Refrigerators jumped back to the second highest year on record, while range sales went to an all-time high of 450,000 units and water heaters were up 22 per cent to 125,000 units.

Fluorescent lighting was easily the big thing in illumination during the year with sales expanding faster than manufacturers could turn out equipment. Under utility guidance fluorescent lighting schools sprang up in a number of places. Less complaint was heard during the year of improper sales methods. Almost all the production was properly equipped with power-factor correction devices. Higher illumination values as the result of fluorescent were experienced last year, some

installations in drafting rooms running almost to 100 ft.-candles.

During the year the new thin wall insulated wires became available, but the greater use was found in industrial modernization rather than commercial, although some progress was made in the latter. Adequate wiring promotion for residences continued to expand during the year, with the result that 42 local organizations, representing about 26 per cent of all domestic meters, are now licensed by the national bureau. Records for a limited number of these groups show an increase in certification over the previous year of nearly 300 per cent.

Engineering

After several years devoted largely to superposition the present capacity expansions have largely reverted to condensing units. The first forced-circulation boiler for utility plants in the U.S.A. was ordered.

The trend toward reliance on wood insulation for impulse strength continued and so did intensification of grounding and the resort to counterpoise installations.

Revived interest was manifested in thermal forms of demand meters, in watt-hour meters immune to lightning influence and in forms of power-factor metering for the rurals and the fluorescent lighting loads in the cities.

Self-supporting cables were applied for residential primaries. Network systems began to win acceptance in industrial plant layouts. There were large increases in installations of corrective capacitors and improved forms of voltage regulators. Current limiters were adopted more widely and a form of quick clearance devised to thwart primary conductor burning. X-rays were applied with success to inspection of pole condition.

Differential scheme of protection found added acceptance, along with bus sectionalization, as a means of enhancing system reliability. Air breakers continue to find their place in station auxiliaries and elsewhere, while fire protection schemes supported the retention of oil-type breakers. There was a growing trend toward mobile meter testing, oil reclamation, power transformer overhaul, etc., into the field by means of mobile workshops.

Rates

Rate reductions were reported by 153 companies aggregating considerably less than 25 millions. This is approximately half the volume of reductions in 1939.

Taxes

Taxes received the heaviest increase last year. Normal taxes went from 18 to 24 per cent and new defense taxes added ½ per cent to federal tax. Reports indicated that utilities in general absorbed this latter added tax.

Local governing bodies began to realize last year the relationship of private ownership to tax receipts. Tennessee tried to secure federal legislation requiring TVA to make up for the taxes lost through the sale of private properties. A measure introduced into the House was turned down. Forty-one states intervened in the New River case because they saw their tax revenues on hydro properties jeopardized. The states lost. Arkansas courts ruled that co-ops were not liable for state sales taxes on power bills. Twenty co-ops in Kentucky refused to pay property taxes, claiming exemption as non-profit bodies. Chattanooga Power Board refused to divert surplus funds to city treasury.

Property Sales

Public purchase of private utility properties continued during the year and gives every indication of going into high gear in 1941. In Nebraska Central Power, Southern Nebraska Power and Interstate Power sold out to Consumers PUD. The total involved was over 10 million dollars. Alabama Power sold its Northern properties to TVA for $4,600,000, while out in the Bonneville area, West Coast Power, Willapa Electric, Washington Gas & Electric and Twin Harbors Electric facilities were taken over. As the year drew to an end, RFC money was pledged to PUDs to buy up properties of Puget Sound Power & Light and Pacific Power & Light. A Northwest pool has been suggested to take in under public ownership all of the power supply of the Northwest. In California condemnation proceedings to take over the Sacramento property of Pacific Gas & Electric were restarted.

Federal Projects

St. Lawrence seemed closer to becoming an actuality last year than ever before. An accord has been reached with Canada and Congress will be asked to ratify a treaty. The project is being put forward this time solely as power development to aid national defense. Maritime states, however, are expected to oppose it on the basis of competitive navigation. Suggestions were also made during the year for new federal projects on the White River in Arkansas and the Savannah in Georgia.

The Grand River development in Oklahoma came into operation late in the year. Bonneville secured its first large contracts for power for steel and aluminum to be used in defense. TVA was able under the plea of defense requirements to secure an additional 65 million dollars for a new headwater dam and steam plant capacity. The Defense Commission approved plans for an Army-owned plant at Muscle Shoals where TVA would make explosives. Santee Cooper was speeded up as a defense measure.

Outside of the PUD's, municipal ownership made very little headway during the year. Elections were won in only 21.7% of the cases, against 46.7% in 1939—population won by M.O. 26,903; lost, 687,507. The state of Kentucky refused to pass an enabling act to permit cities to acquire private utilities. The largest single municipal operation, that of Los Angeles, went through a political upheaval, resulting in a slashing of its commercial budget and the dropping of a large part of its new business personnel.

There were fewer serious labor disturbances in 1940 than in the previous year. Several utilities held elections for certification of bargaining groups. In two instances, Consolidated Edison and Nebraska Power, independent labor groups won. In two companies where employees on strike had damaged plants, they were held by the courts to be guilty of sabotage and convicted.

Legal

The year was marked by an unusually large number of far-reaching legal decisions. The most important was probably that of the Supreme Court in the New River case extending the regulatory power of the United States over virtually all streams. In holding Consumers Power and two employees guilty of illegally serving a still, the court held that a public utility has the right to refuse service if for any reason it believes service may be used for unlawful purposes. A federal grand jury established a precedent by giving utilities the legal right to severance values. Several co-ops established their right to interfere with farm telephone lines inductively. The Utah Supreme Court held that the State Public Service Commission had no jurisdiction over co-operatives. Municipalities were denied damages suffered because of power company injunction against PWA operations. The state of Oklahoma was denied the right to file an injunction against the construction of Denison Dam. The agency agreement which the city of San Francisco had with Pacific Gas & Electric for distribution of Hetch Hetchy power was held to violate the Raker Act.

Storms

Several bad storms were experienced during the year. The sleet storm in the Northeast was the worst in 25 years. Snow and a Northern winter experienced in the Southeast did little damage, but added considerably to the heating load. A freak sleet storm in Amarillo took down all the lines, but service was restored in five days with the assistance of fourteen neighboring utilities. A hurricane visited the Carolinas, but service was restored within 24 hours.

Interconnection

Considerable study was made of a power grid tying in the defense areas. A report by the utilities was expected to be made by the end of the year. In the meantime some progress was made in interconnection in Ohio, Indiana, Michigan, Wisconsin, Idaho, Utah, Montana, Oregon, Washington and southern California by private utilities. In the Northwest heavy interconnections were made between Bonneville, Tacoma and Seattle. FPC announced it would not invoke its authority to order interconnection without notice or hearing.

In spite of the heavy additions to generating capacity and increases in interconnections the Federal Power Commission forecast late in the year a power shortage of 1,500,000 kw. in 1942. Reports from utilities in affected areas deny that there will be any power shortage on their systems. In the meantime FPC, with the co-operation of utilities, has been making a questionnaire survey of defense power requirements of 25,000 industrials.

FPC reaffirmed its authority to determine original cost and started hearings on orders to show cause for failure to comply.

Integration

Considerable jockeying took place during the year with respect to integration. At one time it looked as though a test case would be taken to the courts provided a guinea pig for Big B (geographical integration) could be found. This was abandoned. SEC also agreed to make public tentative official integration plans to bring the issue out into the open. This did not materialize. In the meantime integration proceedings were started against the major holding companies and hearings begun. At the same time a large number of consolidations of intermediate holding companies with subsidiaries were voluntarily undertaken and plans announced for the integration of some large groups.

SEC

Holding companies and service companies were ordered by SEC to terminate interlocking personnel. Late in the year E.E.I. was being investigated to see if it should be classed as a service company. Feeling was strong after the election that SEC would push vigorously for compliance with the Holding Company Act.

Three policies of SEC during the year made a profound impression on new financing. One was to require a substantial part of subsidiaries' new financing to be in common stock with public participation. Another was that permission for new financing and dividend payments to parent companies was dependent upon the degree to which referred arrearages had been paid up. A great many such arrearages were paid during the year. The third policy dealt with competitive bidding for security issues and was aimed at private sales.

Money was available to utilities at a lower rate last year than ever before, several issues yielding less than 3 per cent and one, Boston Edison 2¾s, yielding approximately 2½. Some sizable issues of common stock were floated without any difficulty.

Probably the most exciting event of the year was the nomination of Wendell Willkie for President by the Republican party, the first time that a utility man had ever been nominated for such high office.

New Year

The new year gives indications of increased volume of business, both for utilities and for manufacturers. The indications are, however, that considerably less of the increase will find its way into net, due very largely to increasing taxes. This, however, will be a small price to pay if by everybody putting their shoulders to the wheel we can build quickly a national defense that will preserve the American standard of living.

Manufacturers to Keep Pace with General Business

Rearmament emergency program the first consideration, but must continue increase in commercial goods production to maintain the American standard of living

E. O. SHREVE

President, National Electrical Manufacturers Association

IN THE SUCCESSFUL CONDUCT of any business it has long been recognized as necessary continually to study trends, to analyze accomplishments and endeavor to predict a level of operation for the reasonable future. For some years now the National Electrical Manufacturers Association has been endeavoring to carry this ideal into its operation, not of course to the same extent as would be the case in a private business, but at the end of the year to look at the accomplishments during the preceding year, and through the contributions of each member of the board of governors to endeavor to indicate expectations for the ensuing year.

This program for this year has just been completed, and I am very happy to give some of the highlights, reflecting the judgment of these representative men in the electrical manufacturing industry. Of course, any such statements must be viewed with the recognition of their fallibility as they are based upon judgment of men and not upon facts.

1940 and 1941

The year 1940 has seen business attain a level considerably higher than 1939. The electrical manufacturing industry has kept pace with this improvement. The dominant element naturally is the national defense program. The National Electrical Manufacturers Association membership has assumed a large and representative share of the responsibility in reference to this very vital program. To meet this responsibility the industry will spend at least $100,000,000 for new and increased facilities.

The durable goods business has been in line with general business and reflects quite directly in many instances the activities of the defense program.

Consumer goods have been most active and have shown a material increase in most lines over previous years.

N.E.M.A. business development activities have again contributed very substantially to the creation of wider markets.

Profits generally will show better for 1940.

Now in regard to our expectations for 1941, in general the contributors to this symposium have indicated that general business will maintain at least the present level, and in a majority of cases indicate an expectation for better business.

The electrical manufacturing industry will be expected to keep pace with general business trends.

Durable Goods—The volume of durable goods business should at least be the equal of 1940, and probably will show increase.

Consumer Goods—In both major appliances and counter devices there is a very optimistic expectation and substantial increases are expected, running as high as 30 per cent over 1940.

Raw Material Prices—The consensus is that no decided increase in cost of raw materials will be experienced. This feeling is due largely to the government's influence, and to the conviction on the part of industry that such increases would be very harmful.

Labor—Unskilled labor is plentiful. Intensive training programs under way should prevent any serious shortage of skilled labor. The only reason why labor costs may increase would be increase in cost of living, which looks very unlikely. The consensus indicates, and the belief is, that increase in cost of labor will be moderate. I am glad to quote directly from one contributor:

Skilled Labor Shortage

"We are already experiencing a shortage in the supply of skilled labor, but are having no difficulty in connection with unskilled labor or the additional employees which we are absorbing for training. There seems to be a general impression and considerable publicity that wages will be increased. It has not affected our operations as yet and I think every effort should be made to keep both prices and wages stable during the period of the emergency."

Profits—While the volume will probably be greater in all lines, the necessity of capital expenditures for modernization and the imposition of larger taxes will make it difficult to show more than moderate profits.

Price Trends—With every indication that raw material prices will not rise greatly and that labor costs will remain stable, it follows that prices of finished goods will not be increased materially; in fact, there are already indications of decreases in some lines.

Modernization and Expansion—It is the general belief in both the utility and industrial activities that there is more need for modernization than there is for expansion, except to take care of the emergency program.

New Financing—There will probably be a reasonable demand for new financing. In this connection I quote from another contributor:

Financing to Remain Tough

"I see no sign of any immediate change in the restrictions surrounding business financing. It will continue tough."

International Affairs—Of course international affairs will continue to affect our economic picture directly through the emergency program. I quote again from the observation of one of our contributors:

"As long as the war continues a great majority of industrial plants in the United States will be taxed to capacity, with total economic activity at an all-time high. In case of an early peace it would seem that our own national defense program would sustain this level of activity for at least a year.

"The transition from war to peace should be accomplished with less shock than was the case in 1918, due to a better understanding of economic forces and memories of conditions then, which are still fresh in our minds; also because of government controls which have been developed in the meantime. These things should serve to prevent a terrific, even though short-lived, period of inflation such as occurred in 1919 and which ended so disastrously.

"When the war finally is over, it seems to me that we can look forward to a period of the most active competition from foreign countries that we have ever seen. In order to maintain our position in international trade, we shall probably be forced to lower wages, longer hours, and lower profits than any of us have ever seen."

Plant Effectiveness Demanded

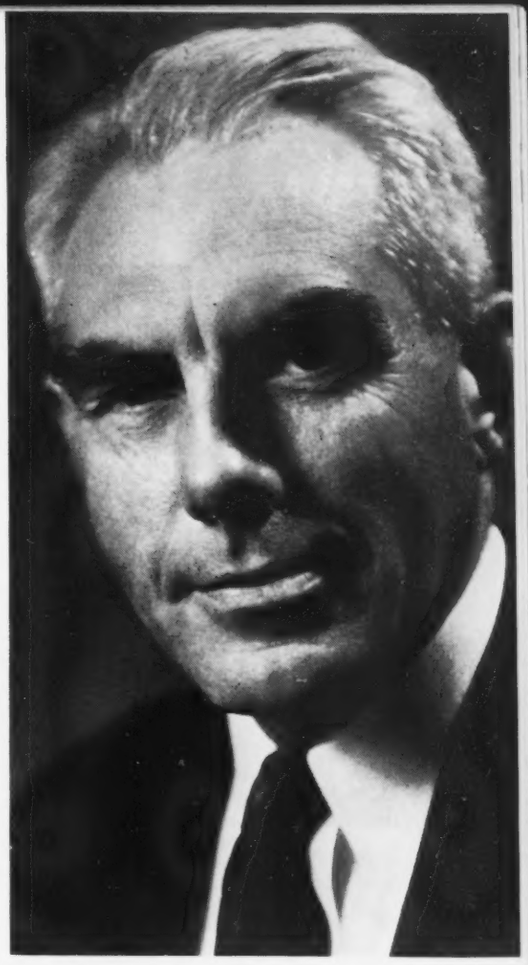
In this contemplated competitive situation, which unquestionably will develop, industry must bring its plant equipment to the highest degree of effectiveness if we expect to minimize the danger of lower wages, longer hours and lower profits.

Advertising and Publicity—In the majority of cases the advertising and publicity budgets will be even greater than for 1940. In no case will they be reduced.

Business Development Activities—It is the consensus that these activities have proved very productive and that they should be continued on an aggressive basis during 1941.

General—Opinions have been expressed such as:

"I can see nothing particular to worry about during the year 1941 or possibly even 1942, but as the present business expansion is to a large extent dependent upon the armament program and the war, it is not a stable and healthy expansion, and as is always so we will pay for it in the long run."



E. O. Shreve

and another:

"My only other observation along these general lines would be a warning not to spend money on brick, mortar and machinery (capital); such procedure will bring chaos later."

Another observation:

"Summing up in general, I would say that we expect to have a lot of work to do, with shortages of needed materials, with lack of skilled labor, and with little desire beyond patriotism, to increase production, because at a certain point increased production means little increase in profit. We are thinking, therefore, in terms of national defense and loyalty to our government, and expect to do our duty as best we may."

Hard Work Will Be Needed

It seems evident to me that if we are to preserve the high standard of living which we have attained we must expect to continue on a higher basis of production for commercial goods, and superimpose the emergency program on this activity. Of course, I believe the emergency program should demand our first consideration. However, I also believe that we can do the job on the basis outlined if our population becomes thoroughly aroused to the real necessities confronting us, so that we may get back to a realization of what good, honest, hard work can and must accomplish. If this cannot be done, then we must expect to slip in our standard of living, because the emergency program must be carried through quickly and effectively.

Editorials

S. B. WILLIAMS, *Editor*

For Thirty-seven Years

FOR 37 YEARS ELECTRICAL WORLD at the first of the year has been rounding up the operating facts of the previous twelve months. At first the data were very few, but they represented all the industry had. Then about 1913 ELECTRICAL WORLD began to compile monthly operating statistics of the power industry. And for some time these were the only monthly data available. About fourteen years ago N.E.L.A. decided to compile and disseminate the operating statistics of the industry and ELECTRICAL WORLD stepped aside. This was carried on by E.E.I. In the meantime the Geological Survey had begun to compile certain data, which operations later were taken over by FPC.

Thus has the gathering of electric utility statistics evolved, until now, except for the weekly releases by E.E.I., all of the basic data are compiled by the Federal Power Commission.

Because FPC has a different concept of what constitutes the electric utility industry from that previously held by others, its data differ in totals but not in ratios. The commission holds that all organizations generating power for resale belong to the industry. Some companies normally classed as transportation or manufacturing are now included. This will account for some apparent large changes in totals when compared with data in previous issues. In this issue we have gone back several years in order to make data comparable.

There are also some changes due to reclassification made to conform to classifications in the new uniform system of accounting. We realize that this is going to be confusing to any one using the totals as indices of market extent. The changes between years are much more accurate as indices of movement.

Except for the data in construction budgets and new capacity in generation, transmission and substations which ELECTRICAL WORLD compiles, the figures were supplied by several sources and we have acted merely as differentiators and as integrators. May we at this time express our appreciation to all those who have helped us with this issue, including FPC, REA, Department of Commerce, E.E.I. and N.E.M.A.

The presentation this year has been streamlined for speedy reading. The text is not a running story, but instead a series of comments on trends as indicated by a study of published data. As usual, the statistics are presented in a number of small groups. In looking for trends, however, groups were correlated.

It is our opinion that one can now in a very short space of time get a comprehensive view of the year just passed, as well as an indication of trends, at least as far as can be revealed by cold figures.

Low Incremental Revenue

THE INCREMENTAL RATE for commercial consumption last year was 1.6 cents, for residential 7.1 mills, for industrial 5.8 mills. In other words, the ratio of the additional money received last year for the additional kilowatt-hours sold in each classification was the incremental rate as stated.

How far will those incremental rates support the additional 9,500,000 kw. of capacity installed in 1940 and on order and all of the transmission and distribution that ultimately will go with it? If a kilowatt of capacity, including all of the trimmings, bears an investment cost of approximately $350, then this new capacity represents an ultimate investment of 3.3 billions. Can incremental rates such as those cited above earn a reasonable return on this new investment?

For years the investment account was practically stationary and low-yield incremental business was so much "velvet." But now, with constantly increasing construction budgets, the investment account is on the move. It makes no difference who holds the investment. It represents property on which a return must be earned.

The most eloquent figure in the first paragraph of this editorial is the commercial incremental. How much is being done to build up this load? Judging from the rate at which it is being outdistanced by residential, it would appear as though commercial was still a stepchild load. And yet with the growing lighting mortality due to fluorescent, this load needs every bit of help it can get—let alone the higher incremental so necessary to help earn a return on new investment.

Passing on Taxes to Consumers

TAXES went up 65 million dollars last year. This amounted to 2.7 cents out of every dollar of revenue. How much of this amount was passed on to the consumer?

Taxes now take almost the same as labor; in fact, a tax increase this year equal to that of last year will put the tax well ahead of salaries and wages. Taxes take nearly twice the cost of fuel. Taxes take three times the cost of maintenance.

These comparisons are cited merely to indicate that taxes are now almost the major item of expense. Some of the increased tax burden is now being passed on, but more must be done in this direction.

It must be obvious by this time that taxing bodies view utilities as tax collectors. Other industries are also tax collectors—tobacco, liquor, gasoline, just to mention a few. These others pass on increased taxes, and we, as consumers, are conscious of it.

Last year when the extra one-half per cent federal tax was imposed a great many utilities made a point of absorbing the tax and advertising the fact. This extra tax will amount to more than $7,000,000 during the year. Why shouldn't this be collected from the consumer?

And if additional defense taxes are to be imposed this year, as seems most likely, what then?

Sooner or later the utilities will have to take a leaf out of the book of the filling stations—so much for kilowatt-hours, plus so much for taxes. And then will the utilities be acting in their true role of tax collectors.

Residential Load Mortality Data

SOME rather interesting information regarding the residential customer has recently been revealed by an unpublished survey made by a company serving a heavy industry area where labor layoffs have been frequent. It may perhaps explain why the upward trend of the residential-use curve successfully resists all but the most severe depressions.

Studies of bills of factory workers revealed no appreciable diminution in use when these people were out of work. In one meter route of 475 mill workers with irregular employment there was not one case where 1939 consumption was lower than 1938. This company had to search through 4,000 accounts in each district to find 30 declining users.

Except for non-payment disconnects, not a customer attributed the decline to economy of use. Rather, it was due to some such change as size of family, or smaller quarters, or a refrigerator replacement.

In other words, the mortality of residential load is due to conditions beyond the control of the utility. Barring long periods of unemployment, usage will hold up at the levels to which the customer has been accustomed. So long as the services supplied by electricity are essential this can be expected to continue.

Defense Production

IN HIS fireside chat of two weeks ago President Roosevelt aroused the people of this country to the seriousness of our job of rearmament as well as of giving aid to Britain. He has called upon the nation to give all to this program without fear of economic consequences.

The notion of "business as usual," he said, must be discarded because the job cannot be done by adding defense requirements to normal production. In other words, normal production must yield to defense business.

No one questions for one moment the importance of speeding up defense production, but it is extremely difficult to understand why a drastic upheaval in our normal economy is necessary or even desirable.

If every factory in the country were turned over to the defense production tomorrow, we wouldn't accomplish an awful lot more right now. It takes a little time for momentum to pick up, but as soon as it does we shall be turning out equipments of war faster than they can be used.

Unquestionably, there will have to be an extension of defense production, but can this not be done in an orderly way, without greatly disturbing our scale of living? In fact, it must be done that way, for how else will we build up the national income necessary to produce the desired tax revenue?

On the other hand, the President has the opportunity to provide space for defense production by tabling spending for non-defense activities. Every government power spending agency takes up manufacturing capacity that could be devoted to defense. If we need manufacturing capacity so badly, why are we taking up the time of now overtaxed manufacturing engineering forces to work out designs for new federal power projects?

Surely the government which asks for personal and business sacrifices should be willing at this time to sacrifice its antagonism to one part of American business—a part that is better prepared for defense than any part of the government.

Common Stock Financing

LAST YEAR the electric utilities invested approximately 600 million dollars in new construction, but they issued only about 90 millions of new securities.

It is known that around 300 to 350 millions were available annually from reserves to invest in new construction, but that still left 200 millions or more to come from some other source.

This year the expected construction expenditures will be 724 million, or more than twice the sum available from reserves. And, unless we are terribly mistaken, the budget for 1942 construction will be still larger.

It is becoming more and more obvious that utilities cannot long shun new permanent financing. For independent companies this should present no problems other than those normally associated with financing. For subsidiaries of registered holding companies the task may not be so easy. Pressure will be applied to step up equity financing. There was a market for new utility common stocks last year and presumably there is one now, although nobody knows how much.

It is also apparent that there is a bottom to refunding yields. Already the market is beginning to resist certain yields as being too low.

In other words, there are some indications that equity financing, in spite of the difference in the cost of money, may have to be used more extensively.

Esauing States' Rights

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

WENDELL WILLKIE was asked by a heckler at a National Press Club luncheon, shortly before the Philadelphia convention, why he had left the Democratic party.

With a patness so apt that some suspected the question had been planted Willkie retorted that he had not left the Democratic party—the Democratic party had left him. He explained that he had belonged to a party of whose two patron saints one, Thomas Jefferson, had believed in state rights, the other, Andrew Jackson, had paid off the federal debt.

Willkie did not connect up the two points, but actually there is a very close connection. The federal government has stamped out some state rights which were regarded as rather fundamental just a little while back—as, for example, when Franklin D. Roosevelt was Governor of New York and wanted his state to have a voice in any St. Lawrence power development—by the simple expedient of increasing the national debt.

When there is a flow of millions of dollars from Washington to a given community the citizens in that vicinity are apt to be more interested in the money, which is very practical, than in theoretical discussion of the loss of local powers. Especially if assertion of the local rights might cut off the inflow of money.

All Tied Together

In this very rapid encroachment of federal on state rights in the last few years the situation with respect to the electric business has played a stellar role. Desire of the Administration to expand publicly owned electric systems and to regulate more closely existing private electric systems has been way out in front of certain other encroachments, though there is a vital interrelation among them all.

During the height of the drive to restrict cotton planting under the old AAA the writer heard some farmers in South Carolina saying that their own county agent was encouraging them to cheat by planting more cotton than allowed under the restrictions. In short, they were being paid by the federal government not to plant certain fields in cotton, but they were planting them anyhow, with the benevolent approval of the man paid by the federal government to check on them!

Asked about the morality of this, one of the farmers replied:

"Why, this is the first money we have got out of those Yankees since the Civil War!"

The Mess of Pottage

The interesting point here is not a survival of Civil War feeling, nor of the sense of morals of a lot of farmers who thought they had been badly treated by the federal government for a good many years. The importance lies in the fact that it was the South, from the Mason and Dixon line to the Gulf, which was the section of the country most devoted to preservation of states' rights. Southerners will tell you that the Civil War was not fought to preserve slavery, but to preserve states' rights. Virginia had come within one vote, in her legislature, of abolishing slavery before the civil war. But there was no such close division of opinion in the Old Dominion about states' rights. The Virginians were pretty nearly unanimous about that—in those days.

But the flow of federal money, obtained by the simple expedient of increasing the national debt, has made quite a few changes.

There was an Alabama man on the Supreme Court a few weeks back who voted in favor of reversing the lower courts in the New River case. This seems to mark the end of one phase of state rights. Under this new precedent the federal government calmly takes control over all streams, not those just "navigable" in fact, which was the old rule under the commerce clause of the Constitution, but any stream in which a boy could float a canoe. More important, any stream with enough current to turn a mill wheel—or a turbine!

That Alabama man was Hugo Black, who as senator became famous as head of a Senate committee which seized private telegrams in an investigation of the electric industry, and also for his prominent part in the "death sentence" fight of the utility holding company bill.

How radical has been the change in viewpoint about this states' rights question is illustrated by this New River case, not only in facts but in personalities. Back in the early "Progressive" days, leading up to the nomination and election of Woodrow Wilson in 1912, one of the foremost progressive Democrats of the country was Newton D. Baker. He and his friends opposed the nomination of Judson Harmon, of their own state of Ohio, at the Baltimore convention because he was a "reactionary." They favored the nomination of Wilson because he was a progressive.

Baker later became Woodrow Wilson's wartime Secretary of War, still regarded as an outstanding progressive.

States' Rights—Reactionary?

But it was Newton D. Baker, in the lower courts, who went further than any other attorney in fighting the invasion of states' rights by the federal government which the New River case involved. Baker was roundly denounced for this activity by the New Dealers. To hear them one might have thought he had abandoned all his principles so that he could earn a fat fee, or that he was like certain prominent liberal leaders, from time to time, in England, who were made peers and turned into conservatives forthwith.

[*Continued on page 217*]

NEWS OF THE WEEK

Budget $150,000,000 for Power Activities

President's budget to Congress lists $69,800,000 for TVA and $12,958,500 for Bonneville — Federal projects under construction to get additional funds

President Roosevelt's 17½-billion-dollar budget, submitted to Congress last Wednesday, contains budget requests totaling $150,000,000 to carry on construction of New Deal power projects and distribution systems during the fiscal year beginning July 1, 1941. Of this sum, nearly $28,500,000 is specifically earmarked for distribution and transmission facilities, the rest for continuing construction of hydro-electric and TVA's emergency defense steam-generating plants.

Omit New Projects

No new projects are given funds to get them started in next year's budget recommendations. This does not assure that no new projects will be started, however. Any of the pending power developments for which the Congressional "power bloc" can wangle a national defense aura will get a prompt green light and whatever funds that can be spent on them before midsummer of 1942.

Total appropriation recommendations for civil (as separate from military) public works, which includes power projects, is not cut as sharply as the President's remarks in recent weeks had suggested. In fact, from the power standpoint, the total amount budgeted is probably slightly higher than normal schedules would have called for, and in one major instance (Grand Coulee) money to continue irrigation work is diverted to accelerate power dam construction elsewhere.

Biggest chunk of the federal power money goes to the Tennessee Valley Authority, which is listed for $69,800,000 in direct appropriations. This, with TVA's own funds and a $1,635,000 bond issue, brings the agency's total expenditures for multi-purpose operations to $76,484,000. Of TVA's direct appropriation, $30,100,000 is to continue the "defense" expansion program initiated last summer; the rest is equal to TVA's 1941 budget appropriation. TVA plans to spend $14,957,000 for transmission lines.

Second largest power appropriation is for Bonneville, which is budgeted $12,958,500 for distribution facilities and $7,170,000 (to the Army Engineers) for additional generator installations. Grand Coulee is budgeted $8,000,000, all of which will go toward completing the dam and installing power units. Work on the pumping plant and irrigation works will be shelved until a future date.

Money saved by curtailing the Grand Coulee program will go to speed work at Parker Dam, Central Valley and the Colorado-Big Thompson projects, which are allocated $6,000,000, $25,000,000 and $2,900,000 respectively. Army Engineers are allotted $1,845,000 for Fort Peck construction and the Bureau of Reclamation $500,000 for transmission facilities for the same project. In addition, part of the Army Engineers' $70,000,000 for continuing flood-control work doubtless will go into power-generating facilities.

Rural Electrification Administration is listed for only $3,946,000 for administrative expenses in the regular budget, but it has previous authority to draw on the Reconstruction Finance Corp. for $40,000,000 in fiscal 1942 to continue its program. A Congressional move to increase this borrowing authority up to the current year's level of $100,000,000 or beyond is certain to materialize.

Agencies Get More

In his modest success at pruning the administrative expenses of the government the President did not use the knife on any of the federal regulatory agencies with jurisdiction over utilities. All of these are budgeted for increases.

Federal Power Commission's budg-

ATTENTION PEDESTRIANS—By lowering its plate glass window settings practically to child's height above the sidewalk, Boston Edison gains the interest of passersby in its main merchandise store at 39 Boylston Street, contrasted with the former high wall panels which cut off much of the interior

eted $2,754,437 includes an increase of $95,000 for salaries and a $150,000 item for national defense activities, which is equal to the amount the President gave this agency from his "blank check" money this year. Securities and Exchange Commission gets $5,440,000, the same as the current year's appropriation, except for $50,000 additional for salaries for administration of the investment regulatory laws. Federal Communications Commission is listed for $4,259,729, which includes $138,889 more for salaries and an increase of $320,000—to $1,920,000—in its national defense investigation fund.

•

New England Utilities to Meet All Demands

Whatever the demands occasioned by events of the coming months, the electric utilities of New England are ready, according to Frank D. Comerford, president of the Boston Edison Co. and chairman of the New England Power Association.

"It is an inherent part of our business that we must be prepared for emergencies a long time in advance, even before they appear on the horizon," Mr. Comerford declared. "Since we cannot build a new power station overnight or produce a new generating unit at a week's notice, we maintain at all times an ample reserve, and our construction programs are projected four or five years ahead."

Mr. Comerford pointed out that when the war began in September, 1939, the association anticipated that the demand would increase more than normally, and therefore an order was immediately placed for a new 40,000-kw. steam unit for the Narragansett Electric Co. at Providence. This unit is now almost ready for operation. Early in 1939 the Boston company completed a program adding 65,000 kw. to its generating capacity, and last summer, when Congress had multiplied the national defense appropriations many times, the company ordered 58,000 kw. of added capacity, with deliveries anticipated early in 1942.

The major electric systems of New England came to the end of 1940 with new peaks established in almost every branch of the business, with the exception of net revenues. Total outputs are greater than ever before. Boston Edison produced for customers on its own system more than 1,300,000,000 kw.-hr. in 1940, a gain of about 4.5 per cent. That company reduced rates October 1, 1939, by $800,000 per year, and in 1940 New England Power companies reduced rates by more than $700,000.

The trend of taxes is upward, Mr. Comerford emphasized.

NEWS BRIEFS

THE LONG ARM OF THE LAW caught up with three men, including an employee who planned the robbery, who made off with $610 loot in a hold-up last November 22 of a branch office of Consolidated Edison Co. of New York. They were sentenced to Elmira Reformatory. A fourth defendant, who did not participate in the robbery but received part of the loot, was sentenced to 2½ to five years in the state penitentiary, but execution of the sentence was stayed.

COMMONWEALTH EDISON CO., Chicago's big utility, reports that its stockholders now number more than 100,000, an increase of 12,000 since January 1, 1940, and the gain, which was in holders of 100 shares or less, was accompanied by wider geographic distribution.

TRUSTEES OF CORNELL UNIVERSITY have authorized construction of a new $150,000 high-voltage laboratory for the College of Engineering. It will be provided with both 60-cycle and impulse-testing equipment.

ELECTRICAL CONTRACTORS of Fond du Lac, Wis., through the co-operation of L. A. Falk of Wisconsin Power & Light Co. and others, have formed an adequate wiring bureau, the second of its kind in the area served by this utility. Sheboygan has had a bureau since last spring and one is in the process of organization at Beloit.

NATIONAL SAFETY COUNCIL, INC., Chicago, has published a booklet, "Prevention of Night Traffic Accidents," containing facts and recommendations for night traffic safety.

SAFETY PAYS BIG DIVIDENDS for drivers of Houston Electric Co. President Bert Gray says 418 of the company's drivers will share in a $22,255 pot that has been laid away for safety bonuses. The average will be $52, although 217 will get $60. Each driver will receive $5 for each month he has driven during the year without a chargeable accident.

WITH FIVE JUDGES selected, approximately 2,000,000 foremen, sub-foremen and workmen in the American metal working industry can now get down to brass tacks to put forth their suggestions which would aid in speeding national industrial defense. President C. Donald Dallas of Revere Copper & Brass, Inc., says there is $10,000 in prizes awaiting the ten best suggestions.

ON THE SANDY PLAIN near Falmouth more than 20,000 workmen are using 1,000,000 ft. of lumber in constructing Camp Edwards at Cape Cod, Mass. Electricity is now playing and will continue to play a greater role when the 1,200 barracks and mess halls and 93 hospital sections of this wooden city get under way. It will require a telephone exchange capable of serving a city the size of Taunton.

SIGNATURES OF real customers asking for rate investigations are essential to outside-initiated inquiries for action by the Massachusetts commission, which has dismissed several cases lacking proper procedure in this connection. It has long been too easy to collect names on petitions for all sorts of objectives in America.

•

Files FPC Protest Against Power Dams

California, through its state Department of Public Works, has again registered a vigorous protest with the Federal Power Commission against the granting of licenses for construction of the Pulga and Cresta plants on the Feather River by Pacific Gas & Electric Co. Basis for the protest is that additional Feather River power would interfere with the marketing of power from the Shasta Dam plant of the Central Valley project.

Frank W. Clark, state Director of Public Works, asserts that Shasta Dam power will be available by July, 1943, provided Congress appropriates necessary funds, although other estimates place the date of energy delivery from one to two years later than that date.

P. G. & E. recently renewed its applications for licenses for the 68,000-kw. Cresta and 80,000-kw. Pulga plants so as to assure the region it serves of adequate power facilities. The licenses had previously been denied by FPC without prejudice. In the meantime the FPC report on power for defense was released containing the charge that a possible power shortage might occur in northern California and southern Oregon in 1942. Should this contention prove accurate it would be necessary for P. G. & E. to begin immediate construction of the Feather River plants to have power available within the limit set by the FPC study.

•

Plans Diesel Plant

Wisconsin Public Service Commission has announced that the Elkhorn municipal utility has been authorized to construct and install a Diesel generating plant at a cost of approximately $180,000. At the present time the city is purchasing its electric energy from the Wisconsin Gas & Electric Co.

Utility Sales Leaders Convene at Bridgeport

Approximately 400 attend thirteenth annual "central station" sales conference of General Electric — Large volume of new business predicted

Products and order books were relegated to second place when upward of 400 utility sales executives gathered at Bridgeport, Conn., for General Electric's thirteenth annual "central station" sales conference, held last week. Seven entirely new ranges and a new home laundry were shown. A similar program was held at Chicago this week.

An increase of 44 per cent in small appliance sales and of 20 per cent in large appliance sales was announced in the opening address by Carl M. Snyder, appliance and merchandise sales manager, with big increases looked for in 1941.

Champagne Booms

Expenditures for champagne in Bridgeport in recent months jumped 1,250 per cent while expenditures for local residential electric service increased only 8½ per cent, Harold F. Smiddy, chief operating sponsor Ebasco Services, pointed out. This half-frivolous comparison, he said, shows the competition for the customer's dollar which faces utility sales forces.

The utility industry must keep young, Mr. Smiddy said by keeping progressive, by seeking out and selling and pioneering the new uses and services, through such devices as the automatic electric blanket, the home laundry, the home workshop and the dishwasher.

Speaking extemporaneously, Philip D. Reed, G.E. chairman, summarized the present international and domestic situation and interpreted the significance of today's events to American business men. Every form of production has a part in defense, he pointed out, because production helps to maintain our standard of living, because supplies are increased by production, inflation is checked and, in the end, all production helps to pay the tax bill for the nation's defense.

In predicting the outlook for the next decade, H. H. Bosworth, manager of central station sales, foresaw an average residential usage of 1,800 kw.-hr. in 1950, a bill of $45, a total of 30,000,000 customers and 54,000,000,000 kw.-hr. sales. Saturations, he said, will be 80 per cent, 30 per cent and 10 per cent respectively for refrigerators, ranges and water heaters.

Larger budgets for E.E.I. sales activities were announced by C. E. Greenwood, commercial director.

A comprehensive program for utility and dealer-co-ordinated sales was outlined by Chairman Walter H. Sammis of the Modern Kitchen Bureau.

A net-income campaign embracing the sale of 4,000,000 bulbs to 900,000 customers by 10,000 employees was described by Edwin Vennard, vice-president of Middle West Service Co. E. O. Shreve, NEMA president, outlined the work performed and services rendered 362 member-companies and Ashton B. Collins summarized compelling reasons for revisions of utility advertising policies.

The operating economy of a modern modest electric home was presented by C. W. Stuart, manager G.E. Home Bureau. H. Freeman Barnes, presented the case for fluorescent lighting, and among other speakers were L. A. Hawkins, executive engineer G.E. research laboratory; L. E. Moffatt, editor of *Electrical Merchandising;* John Hansel, vice-president of N. W. Ayer & Son, and J. S. Bartlett, president International Association of Electric Leagues.

POISED—FOR BIG YEAR—Approximately 400 utility men gathered at Bridgeport, Conn., last week for the thirteenth annual central station sales conference heard General Electric executives predict big increases in appliance business for 1941 on top of 20-40 per cent increases last year

•

St. Lawrence Project Visions Wider Plan

The Canadian and United States committees on the St. Lawrence waterway and power project have reached an agreement on a new plan which is a considerable enlargement of that which the United States Senate rejected in 1932.

The new plan not only embraces power development and navigation works on the International Rapids section, but also works to preserve the scenic beauty of Niagara Falls and the levels of the Great Lakes. The cost is considerably in excess of the original $250,000,000.

This week the New York Chamber of Commerce issued a report protesting the development of St. Lawrence as a "national defense" measure. The report urged Governor Lehman and the State Legislature to reaffirm opposition to the undertaking. "No sound argument or evidence has been advanced to show that the St. Lawrence project is vital to the national defense of either the United States or Canada," the report stated.

•

Border Facilities Asked by Mexican Utility

Light and Power Company Acuna S. A., a Mexican company having the legal name of Cia Luz y Fuerza Motriz de Acuna S. A., with an American office at Del Rio, Tex., has applied to the

Federal Power Commission for a presidential permit for the maintenance at the international boundary of physical facilities for the transmission of electric energy from the United States to the Republic of Mexico.

Electric energy has been exported from the United States to Mexico through the Port Villa Acuna, Coahuila, Mexico, under a permit granted in 1936. The applicant states that the 1936 permit did not include an authorization for the maintenance at the boundary of facilities as required under a presidential permit.

•

Canada to Build New Hydro Power Station

The Ontario Hydro-Electric Power Commission plans a $40,000,000 expansion of power generating facilities on the Canadian side of the Niagara River and present diversion of 5,000 cubic feet of water a second at Niagara Falls, according to Dr. Thomas Hogg, chairman.

Dr. Hogg said that the Canadian government will ask for a revision of the 1929 treaty to allow the commission to divert 10,000 additional cubic feet a second from Niagara Falls to be used for a new canal to a new hydro plant at Queenston, Ont. Since November 1 an additional 5,000 cubic feet has been diverted to generate 47,000 kw. at its Niagara Falls, Ont., plant and sold to Canadian Niagara Power Co., subsidiary of Niagara Falls Power Co. and exported to the United States for use by the Union Carbide Co. at Niagara Falls, N. Y., which is producing ferroalloys in electric furnaces for the British government.

New Contract

Col. William Kelly, president of Niagara & Eastern Power Corp. and vice-president of Niagara Falls Power Co., said that the Canadian Niagara Power Co. entered into a new contract with the Hydro Commission recently to take the additional 47,000 kw. which are carried over high-tension lines to the Union Carbide plant.

The Hydro Commission is making foundation studies for a new 50,000 hp. generating plant on the Welland Canal at De Cew Falls, near Thorold, Ont.

•

City to Serve Co-op

City officials of Bloomfield, Iowa, have signed a five-year contract with the Southern Iowa Electric Co-operative, Inc., under which the city agrees to supply electric power for the co-operative from the municipal plant.

SEC to Release Plans for U.G.I. Integration

Tentative views on Section 11 likely to shed light on what the commission expects from other systems to comply with act — National defense will not delay compliance

Release of the Security and Exchange Commission's "tentative views" on how Section 11 of the Holding Company Act should be applied to the United Gas Improvement system may light up the direction utility integration proceedings will take in 1941.

SEC's "blueprint" for UGI is expected to be finished early this month and turned over to the company. Views of the commission and its staff have been reconciled regarding application of Section 11 to this system—what remains is for SEC to decide how far to go in stating its tentative view: Whether simply to state its conception of what integrated systems U.G.I. controls, to state that and develop a prospectus for U.G.I. to bring its affairs within the SEC's idea of what Section 11 requires, or to stop short at some point between these extremes.

Play Close Game

Most expected is that SEC will hold its cards close to its chest and outline little more than what it presently believes is the U.G.I. set-up. Even this, of course, would put this case far in advance of other integration proceedings and possibly pave the way for a rather prompt "arranged" argument of the Big B standard before the commission proper.

Widespread conviction is reviving at SEC that until there is a clear-cut expression by SEC of its interpretation of the Big B standard progress in applying integration will be slow. This doesn't mean there is an all-out effort to "set up" a special case to bring up this issue out of turn, such as was seriously discussed last summer, but it does mean that more and more both the commission and members of the public utilities division of the staff are looking forward to the time when this issue will require an answer.

A review of what has happened toward effecting the integration provisions of the act since the mass citations of major systems last spring helps to explain this tendency. The SEC believes that considerable progress has been accomplished since the Section 11B1 citations were issued; they also realize that real progress has been slow and rather hit-miss.

This big group of cases has divided into three sub-groups, each taking a different line of procedure.

Three cases—Cities Service, Middle West and North American—have been going forward with tedious compilation of a record regarding each of the systems' operating subsidiaries. Evidence relating to the Missouri, Western, Rocky Mountain and Ohio operating systems of Cities Service has been introduced, and when hearings resume January 27 similar testimony relating to other properties is expected. Middle West has introduced testimony on its Oklahoma, West Texas and southwestern properties, while North American has spread onto the record evidence relating to its Kansas-Nebraska, Union Electric, Wisconsin Electric Power, Cleveland and Washington units, and will continue this procedure Jan. 13.

The SEC "blueprints" for U.G.I., Commonwealth & Southern and Engineers Public Service may eliminate the necessity of all this time-taking evidence designed largely to provide a record upon which to identify existing integrated systems. Meanwhile, this second group of cases has largely been at a standstill.

Switches Emphasis

A third group, exemplified best by Electric Bond & Share, has been switched away from emphasis on Section 11B1 over to hearings designed to accomplish corporate simplification under Section 11B2. In a class by itself is the Standard Gas & Electric system case. This citation has, practically speaking, been dormant while SEC watches progress of the company's own program of working toward integration a step at a time.

Admittedly, part of the reason for this apparent lack of correlation in applying the act is due to SEC's own "feeling our way" policy in getting untried legislative requirements functioning. It is not due to any feeling within the commission that the act should not be put into effect, or that its application should be delayed or slowed up because of the defense program. Commissioner Healy's recent speech, in which he stated that compliance with Section 11, in his opinion, would actually promote defense by putting the utilities on a sounder footing, is evidence enough of that.

TVA Reports 3% Yield on Power Investment

Government power project shows power revenue of $15,285,073 and net income after interest of $4,299,229 — Added three new dams during 1940 fiscal year — Others being built

The Tennessee Valley Authority, reporting to the President and Congress on operations for the fiscal year ended June 30, 1940, shows total power revenue of $15,285,073 and net operating income of $4,587,716 after expenses, depreciation and taxes and equivalents, representing a return of approximately 3 per cent on an average net investment of $150,000,000 in completed fixed assets relating to power, including allocated common investment. Net income after interest was $4,299,229.

During the year TVA sold 3,629,676,000 kw.-hr., at an average price of 4.19 mills, of which 1,681,493,000 kw.-hr. was sold to municipalities and co-operatives, at an average rate of 4.47 mills, for resale to customers.

Three New Dams

Three new multi-purpose dams, Chickamauga, 81,000 kw.; Guntersville, 72,900 kw., and Hiwassee, 58,000 kw., were placed in operation during the fiscal year. This brings to seven the number of such projects completed. Since the close of the fiscal year Congress has approved the construction of Cherokee, 90,000 kw., and a new steam plant of 120,000 kw. at Watts Bar. TVA's activities were greatly expanded by the purchase of the private utility properties in the area, notably by the acquisition of five hydro-electric projects and steam plants of Tennessee Electric Power Co.

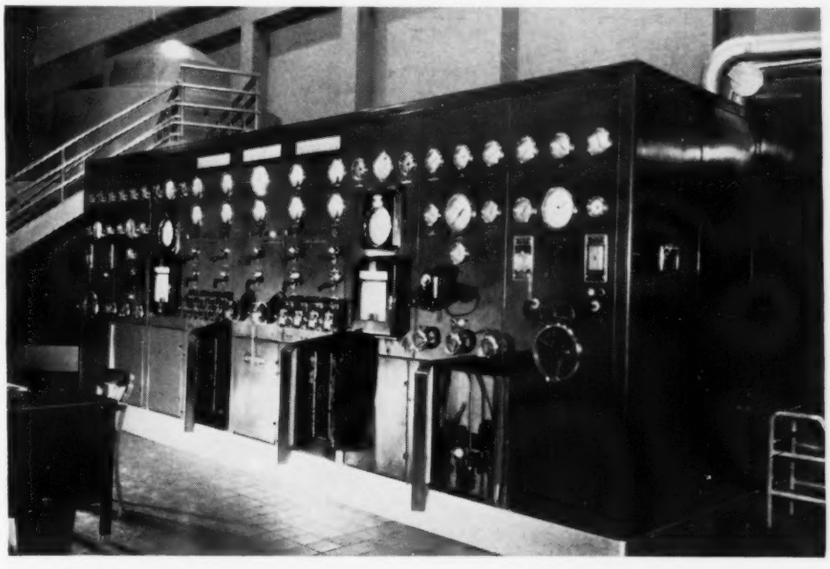
It is expected that TVA will put into service Watts Bar Dam of 90,000 kw. during 1942 and the 128,000-kw. Kentucky Dam in 1945. Completion of Chickamauga, Guntersville and Hiwassee dams added 212,000 kw. of capacity to the TVA system, with three 27,000-kw. units at Chickamauga, three 24,300-kw. units at Guntersville and a single 58,000-kw. unit at Hiwassee.

Including the acquisition of Tennessee Electric Power Co. and properties of Mississippi Power Co. in the northeast of the state, the TVA at the middle of 1940 was selling power to 75 municipal systems and 35 co-operative agencies for resale to more than 400,000 customers. The TVA had installed capacity of 958,000 kw., about 238,000 kw. being former Tennessee Electric Power Co. plants. At the end of the 1939 fiscal year installed capacity was 535,000 kw.

TVA reported a substantial growth in rural electrification in the Southeast. In the service area of TVA and its wholesale distributors, 23,000 farms were added during the 1940 fiscal year, including some 9,500 customers receiving service for the first time by rural lines built by the TVA contractors and rural customers acquired from utility companies.

During the year local appliance dealers sold more than $12,500,000 of appliances, the average sales per residential customer being about $46. These consisted of 35,400 electric refrigerators, 12,600 ranges, 4,700 water heaters, 1,300 pumps, 14,600 washers and 188,400 unclassified items. It is estimated that power used by these appliances will increase the revenue of TVA distributors by $1,000,000 a year.

TVA placed, during the fiscal year, orders for $38,150,000 worth of materials, equipment and supplies, compared with $18,164,000 for the previous year. TVA employed 13,942 persons, against 11,873 the previous year.



GOVERNOR CABINET—Governor cabinet on the operating floor of the power house at TVA's Pickwick Landing Dam on the Tennessee River. The first three panels on each end are for hydraulic equipment control and the three in the center are used for electrical equipment control

•

Hopson Found Guilty in Mail Fraud Trial

The trial of Howard C. Hopson, founder of the billion-dollar Associated Gas & Electric System, and his two attorneys, Charles M. Travis and Garrett A. Brownback, ended last week with the conviction of Mr. Hopson and the acquittal of the two lawyers on charges of cheating the utility system of nearly $20,000,000.

Mr. Hopson was found guilty on all seventeen counts of mail fraud, not guilty of conspiracy. The two lawyers were cleared of all charges. The case, which began on November 6, was tried before Judge Alfred C. Coxe and a jury of eleven men and one woman. Mr. Hopson faces a sentence of as much as five years in prison and a fine of $1,000.

Testimony at the trial brought out that the utility issued $63,000,000 of 4½s of 1948 and that Mr. Hopson bought some $25,000,000 of the bonds with kited checks and sold them back to the system immediately, taking advantage of stock conversion privileges, cut rates, a commission and warrants authorizing bond purchasers to buy stock at lower than market prices. In this way, according to testimony, he made $12,225,726. This profit was wiped out by the stock market crash a few weeks later, and four years later Mr. Hopson gave back to the system $104,508 and called the deal square. Most of the testimony related to the issuance of securities and the Hopson service units.

When Mr. Hopson took over the relatively obscure utility holding company in 1922 it had assets of approximately $7,000,000. Under his guidance it grew rapidly.

Differences Hold Up Hetch Hetchy Pact

Differences over rental charges, stand-by, depreciation allowances and possible net return have jeopardized lease negotiations between San Francisco and Pacific Gas & Electric Co. under which the city would operate the local distribution system. The leasing arrangement had been tentatively approved by Secretary of the Interior Ickes as a legal means of satisfying provision of the Raker Act that San Francisco should not dispose of Hetch Hetchy by-product power to a private corporation for resale.

As soon as details of the proposed lease were worked out San Francisco officials reported dissatisfaction with any proposition that would return the city less than the $2,400,000 annually it was receiving under the existing but illegal agency agreement. City experts contend that under the lease the net return would be only $2,147,000 a year. Under dispute are such items as a $700,000 annual stand-by charge, the flat rental fee of $4,900,000 annually, the carrying charge on annual system additions of $600,000 and other smaller items.

The broad provisions of the lease which Secretary Ickes approved included: (1) A ten-year leasing period subject to termination by either party on six months' notice. (2) P. G. & E. to make all system additions and improvements necessary at city's request or the company might suggest them. (3) P. G. & E. to furnish power requirements above Hetch Hetchy plant output, plus stand-by, plus reserves for future requirements. (4) City to take over essential company employees, guaranteeing them all rights enjoyed in company service. (5) Rates, rules and service regulations to be fixed and prescribed by the city. (6) P. G. & E. to receive $260,000 annually for transmitting, regulating and transforming Hetch Hetchy power. (7) City to reimburse company for pro rata capital stock and income taxes.

Should leasing negotiations fail, the only recourse San Francisco will have will be submission of a bond issue proposal for purchase of the distribution system to the city's voters, who on eight previous occasions have turned down similar propositions.

•

Seek to Buy Utility

Negotiations have been resumed looking to the purchase of the electric properties in Nebraska of the Iowa-Nebraska Light & Power Co., subsidiary of United Light & Power Co., by the Consumers Public Power District of Columbus. It is reported that $20,000,000 is the tentative figure as the purchase price.

•

Nebraska PUD Buys Interstate Power Units

The Consumers Public Power District of Nebraska has purchased the northeastern Nebraska properties of the Interstate Power Co. Charles B. Fricke, president of the PUD, said that the purchase price was $2,600,000.

The electric power generation, transmission and distribution facilities purchased by the PUD serve 38 communities in northeastern Nebraska.

•

Approves Utility Sale

SEC has approved the application and declaration of Central Power Co., subsidiary of Middle West Corp., to sell to Northwestern Public Service Co. its gas utility properties located at Grand Island and Kearney, Neb., for $535,000.

MEETINGS

Missouri Valley Electric Association—Power sales conference, President Hotel, Kansas City, Mo., January 16-17.

Canadian Electrical Association—Annual winter conference of association committees, Montreal, Que., January 20-21. B. C. Fairchild, secretary, 804 Tramways Bldg., 159 Craig St., West, Montreal.

American Society of Heating and Ventilating Engineers—Annual meeting, Muehlebach Hotel, Kansas City, Mo., January 27-29. A. V. Hutchinson, secretary, 51 Madison Avenue, New York, N. Y.

American Institute of Electrical Engineers—Winter convention, Philadelphia, Pa., January 27-31. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

Edison Electric Institute—Electrical equipment committee, Statler Hotel, Detroit, Mich., February 10-12; transmission and distribution committee, Statler Hotel, Detroit, February 17-19. Major H. S. Bennion, managing director, 420 Lexington Avenue, New York, N. Y.

American Institute of Mining and Metallurgical Engineers—Annual meeting, Institute headquarters, New York, February 17-20. A. H. Parsons, secretary, 29 West 39th Street, New York, N. Y.

National Electrical Manufacturers Association—Winter meeting, Palmer House, Chicago, Ill., February 17-21. W. J. Donald, managing director, 155 East 44th Street, New York, N. Y.

Oklahoma Utilities Association—Annual convention, Tulsa, Okla., March 17-18. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

American Society of Mechanical Engineers—Spring meeting, Atlanta, Ga., April 1-3. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Midwest Power Conference—Fourth annual meeting, Palmer House, Chicago, Ill., April 9-10. Charles N. Nash, conference secretary, Illinois Institute of Technology, 3300 Federal St., Chicago, Ill.

Electrochemical Society—Spring meeting, Cleveland, Ohio, April 16-19. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Missouri Association of Public Utilities—Annual convention, Elms Hotel, Excelsior Springs, Mo., April 23-25. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Two Utilities Publish Book on Northwest

A highly interesting and informative book, "River of the West," a story of opportunity in the Columbia empire by Robert Ormand Case, has been published by Northwestern Electric Co. and Pacific Power & Light Co.

Paul B. McKee, president of Pacific Power & Light, and L. T. Merwin, president of Northwestern Electric, in a foreword state that the "purpose of this book is to invite the attention of forward-looking men and institutions to the abundant resources and amazing productivity of that section of the Pacific Northwest served by these two public service companies, which have grown with a steadily growing country that still faces the future with the strength and confidence of youth."

With numerous pictures and statistics of the region, the book tells the story of the section and its products. The two utilities invite inquiries about the region and offer the services of their industrial engineers.

•

Edison Medal for 1940 Goes to Dr. Campbell

The Edison Medal for 1940 has been awarded by the American Institute of Electrical Engineers to Dr. George A. Campbell, "in recognition of his distinction as scientist and inventor and for his outstanding original contributions to the theory and application of electric circuits and apparatus."

Presentation of the medal to Dr. Campbell will be made during the winter convention of the American Institute of Electrical Engineers, to be held in the Bellevue-Stratford Hotel, Philadelphia, Pa., January 27-31.

Dr. Campbell's contributions to the field of telephone transmission and communications have been outstanding. In the words of Dr. Frank B. Jewett, "Dr. Campbell's achievements in this field (telephone transmission) entitle him beyond question to rank first among his generation of theoretical workers in electrical communication."

•

FPC Defers Rehearing

Federal Power Commission, on its own motion, has postponed until January 21 hearing upon the application of Pennsylvania Water & Power Co. for a rehearing with respect to the commission's order and opinion of October 15, 1940, concerning exemption sought from certain provisions of the commission's Uniform System of Accounts.

Output Gain Is 9% First Week of '41

In the first week of the New Year, the week ended January 4, production of electricity by the electric light and power industry rose to 2,704,800,000 kw.-hr., according to the Edison Electric Institute, a gain of 9.4 per cent over the corresponding week of 1940 and of 24.7 per cent over 1939.

The increase in output during the first week of a New Year is customary, but the gain this year over the Christmas week—3.1 per cent—was somewhat greater than seasonal.

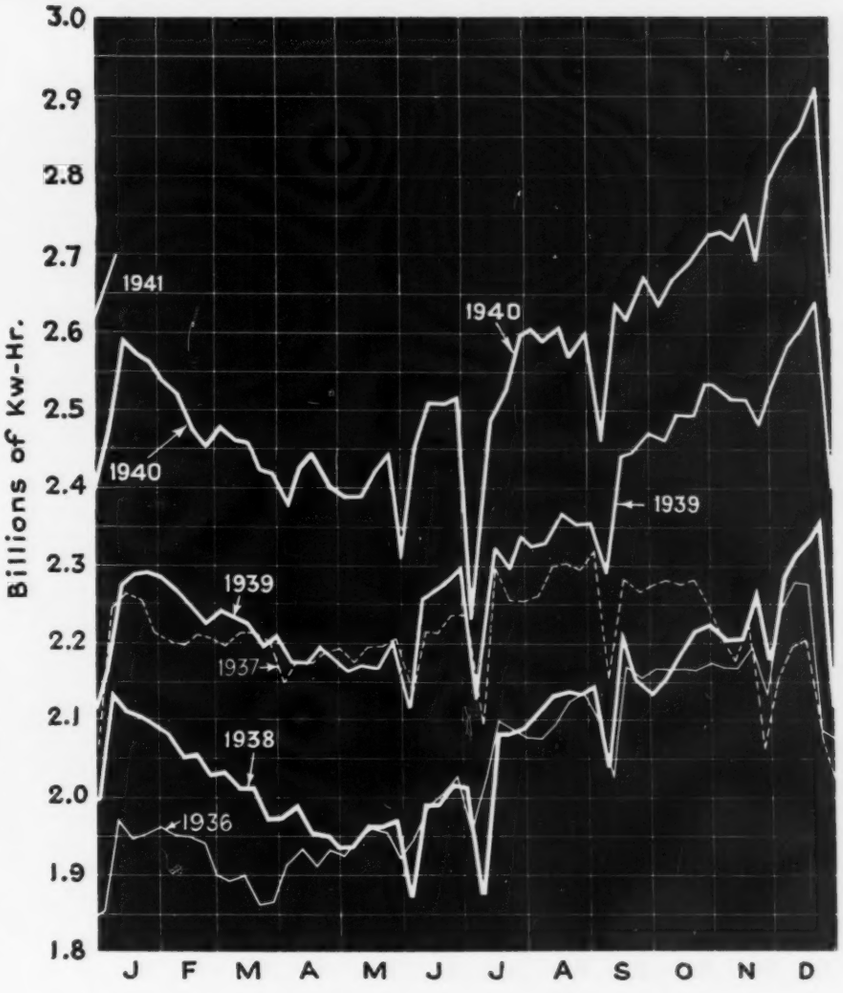
With respect to the major geographic regions, four of the seven showed increased percentage gains over the preceding year in the week ended January 4. Both the Middle Atlantic and the West Central areas rose to 7.2 per cent from approximately 6 per cent each. A small increase in margin was shown in the Rocky Mountain area and an even slighter advance was registered in the Central Industrial section.

Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
Jan. 4	2,705	Jan. 6	2,473	Jan. 7	2,169
1940		1939		1937	
Dec. 28	2,623	Dec. 30	2,404	Jan. 1	1,998
Dec. 21	2,911	Dec. 23	2,641	Dec. 25	2,085
Dec. 14	2,862	Dec. 16	2,605	Dec. 18	2,202
Dec. 7	2,838	Dec. 9	2,586	Dec. 11	2,196
Nov. 30	2,796	Dec. 2	2,539	Dec. 4	2,153
Nov. 23	2,695	Nov. 25	2,482	Nov. 27	2,065
Nov. 16	2,752	Nov. 18	2,514	Nov. 20	2,224
Nov. 9	2,720	Nov. 11	2,514	Nov. 13	2,177

Per cent Change from Previous Year

	Week Ending		
	Jan. 4	Dec. 28	Dec. 21
New England	+ 6.1	+ 7.8	+ 6.7
Middle Atlantic	+ 7.2	+ 6.1	+ 8.5
Central Industrial	+11.6	+11.3	+12.5
West Central	+ 7.2	+ 6.0	+ 8.7
Southern States	+ 9.3	+10.8	+10.0
Rocky Mountain	+ 8.2	+ 7.8	+12.3
Pacific	+ 5.2	+ 8.5	+ 9.0
United States	+ 9.4	+ 9.1	+10.2



Sales Rise 9.7%; Revenue Up 5%

During October a record number of customers of the electric light and power industry, 30,083,421, used a record number of kilowatt-hours, 10,402,022,000, 9.7 per cent more than in October, 1939, for which they paid $207,033,800, or 5.2 per cent more than in October, 1939, according to E.E.I.

Classification of Sales, October, 1940, and Change from 1939 (Revised Series)

	Million Kw.-Hr. 1940	1939	% Change
Residential or domestic	1,922	1,771	+ 8.5
Rural (distinct rural rates)	180	152	+17.9
Commercial or industrial			
Small light & power	1,886	1,767	+ 6.7
Large light & power	5,447	4,848	+12.4
Street and highway ltg.	189	183	+ 3.1
Other public authorities	233	232	+ 0.5
Railways and railroads			
Street & interurban	321	318	+ 0.9
Electrified steam	167	161	+ 3.4
Interdepartmental	58	46	+24.4
Total to ult. consumers	10,402	9,480	+ 9.7

Consumption by the 182,005 large light and power customers, as compared with 188,162 in October, 1939, reached a new high in October, 1940, totaling 5,447,165,000 kw.-hr. While consumption by the small light and power group of customers amounted to 6.7 per cent more than in October, 1939, it was less than in September, 1940, when it totaled 1,925,637,000 kw.-hr.

For the twelve months ended October 31 annual use per residential customer averaged 939 kw.-hr., annual bill averaged $36.34, or a rate of 3.87 cents per kw.-hr., increases of 5.6 per cent and 1.4 per cent in use and bill, respectively and a decrease of 4.0 per cent in rate, over the preceding year.

•

Gain for Appliance Sales

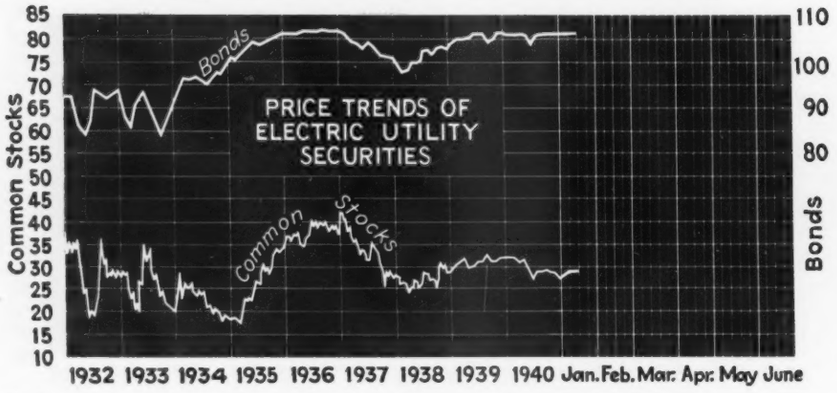
Electrical appliance dealers in the territory served by Virginia Public Service Co. sold 174 ranges, 473 domestic refrigerators, twelve commercial refrigerators, 32 water heaters, 404 ironers and seventeen water systems during November for a total volume of sales of $136,874. For the first eleven months of 1940 total sales were 1,667 electric ranges, 12,275 refrigerators, 549 water heaters and 4,973 miscellaneous items. This was a substantial increase in sales of each item over the same 1939 period.

•

Omits Utility Tax

The Virginia Corporation Commission has entered an order to provide for the omission of $120,000 in taxes on public utility companies in the state. The law provides for an assessment of two-tenths of 1 per cent on gross receipts to be used for the purpose of rate making and appraisals, but allows the commission to omit the tax when it has a sufficient sum on hand with which to carry on the work. This is the second consecutive year in which the tax has been omitted.

Security Prices Move in Narrow Range



Only unsubstantial changes occurred in the prices of electric light and power securities during the past week. The indices compiled by "Electrical World" remained unchanged—stocks at 27.3; bonds at 106.1. Last year, stocks 32.7; bonds, 106.3

Register with SEC $7,500,000 Issue

Luzerne County Gas & Electric Corp. has filed with the Securities and Exchange Commission a registration statement covering $7,500,000 of 3¼ per cent first mortgage bonds due on January 1, 1966.

The corporation will use $7,263,000 of the proceeds from the sale of the bonds to pay on March 1 all of its outstanding 6 per cent first and refunding mortgage gold bonds due in 1954 (except $18,000 which will be retired through operation of a sinking fund) and to pay on April 1 all outstanding 5 per cent first mortgage refunding and improvement gold bonds due in 1948 of the Luzerne County Gas & Electric Co., the predecessor company.

Balance of the proceeds will be used to reimburse in part the corporation's treasury for redemption on March 1, 1940, of $500,000 of its 6 per cent first and refunding mortgage bonds.

•

Call Penn-Ohio Edison 6s

Justin R. Whiting, president of Commonwealth & Southern Corp., has advised stockholders that the corporation has called for redemption on February 1 at 104½ and accrued interest the $5,721,500 principal amount of Penn-Ohio Edison Co. 6 per cent debentures of 1950. Funds for the redemption of the debentures were obtained from the liquidation of Tennessee Electric Power.

•

Will Borrow $475,000

Peoples Light & Power Co., according to an application filed with the SEC, plans to borrow $475,000 from the Provident Trust Co. of Philadelphia. Proceeds from the loan will be used, together with other funds, to redeem on March 1 the company's $1,177,750 outstanding collateral lien bonds, series A, due 1961. The bank loan will be in the form of promissory notes payable serially over a three-year period and will carry a 3 per cent interest rate.

•

Consolidated Seeks Board Approval on Bond Issue

Application has been made to the Public Service Commission of Maryland by the Consolidated Gas Electric Light & Power Co. of Baltimore for authorization and approval of an issue of $12,000,000 series "Q" 2¾ per cent, 35-year, first refunding mortgage sinking fund bonds.

In its petition to the commission the company stated that the purpose of the issue is to refund $5,850,000 of its now outstanding series "M" 3½ per cent first refunding bonds which are to be redeemed at 105 per cent and accrued interest and to reimburse its treasury in respect of capital expenditures for improvements, betterments, extensions and additional property since February 1, 1938, and other corporate purposes.

•

Extends Time for Report

Securities and Exchange Commission has announced that at the request of representatives of the National Association of Securities Dealers, Inc., and of the Investment Bankers Association of America it has extended to January 20, 1941, the date specified for submission of written comment on the report of the staff of the Public Utilities Division with respect to the maintenance of arm's-length bargaining and competitive conditions in the sale and distribution of securities of registered public utility holding companies and their utility subsidiaries, and on the staff's recommended competitive bidding rule.

•

New York Companies File Amendments

Central New York Power Corp. and its parent, Niagara Hudson Power Corp., have filed amendments to their applications regarding the sale of securities by the subsidiary company to the parent company and to the Equitable Life Assurance Society.

Central New York Power proposes to issue and sell $5,000,000 of 3½ per cent general mortgage bonds due in 1965 to the Equitable Life at 101 per cent and to apply the proceeds to the cost of certain facilities. It proposes also to issue and sell not more than 9,000 additional shares of its 5 per cent preferred stock of $100 par value to the parent company at not less than par and to use the proceeds as working capital.

It proposes further to sell not more than 7,417 treasury shares of 5 per cent preferred stock, which it reacquired in 1938, to Niagara Hudson Power at par to reimburse its own treasury. The funds will then be used to meet $741,560 of notes payable to banks.

•

San Diego Gas & Electric Plan Declared Effective

Under a proposal filed with SEC Standard Gas & Electric system will cut loose its subsidiary, San Diego Gas & Electric Co.

An amendment to the original plan whereby Standard would divest itself of San Diego stock declares the plan effective January 15. The plan proposed the exchange of 58 shares of San Diego stock for each $1,000 principal amount of notes or debentures of Standard Gas.

Utility Reports

	1940	1939
*American Power & Light and subs	$11,888,579	$10,223,964
*Central Arizona Lt. & Pwr.	900,849	855,089
*Commonwealth & Southern and subs	13,235,075	13,232,865
*Cons. Gas, Elec. Lt. & Pwr. (Balti.) and sub	6,427,010	6,739,026
*Houston Ltg. & Pwr.	2,916,190	2,804,659
*Kansas City Pwr. & Lt.	3,762,245	3,863,044
*Louisville Gas & Elec. (Ky.) and subs	2,867,352	2,746,050
*Nevada-Calif. Electric and subs	482,840	334,850
*Pacific Power & Light and sub	799,511	911,023
*Southern Colorado Pwr.	218,262	263,099
*Texas Electric Service	1,326,086	1,329,832
*Utah Power & Light†	2,022,501	1,483,819
*Washington Water Power and sub	2,871,643	3,047,772
*Wisconsin Public Service and sub	1,799,270	1,589,376

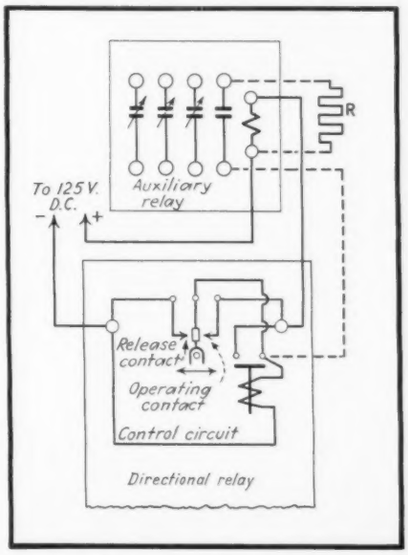
* Twelve months ended November 30.
† Including Western Colorado Power.

OPERATING PRACTICES

Auxiliary Relays in Old Installations

By M. R. HOWELL
Central Illinois Public Service Company, Springfield

Relay engineers frequently wish to obtain the advantages of modern, dependable, high-speed auxiliary relays in old directional control relay installations. At the same time it is also desirable to retain all the desirable characteristics of the three-phase directional (or reverse power) relay control circuit.



AUXILIARY relay added in old installation

The method shown in the accompanying diagram eliminates the delayed action effect, when the auxiliary relay is de-energized, due to the coil-discharge current circulating through the resistor. The method also retains full potential across open operating contacts in the directional relay and therefore has an advantage over other methods which have been used.

The auxiliary relay which was used in many of the old relay installations of this type had a 0.1-amp. burden or more, which was sufficient to operate the auxiliary relay connected internally in the directional relay. The new relay has only a 0.06-amp. burden approximately and it is necessary to add the multiple resistor to operate the internal auxiliary relay.

In the accompanying diagram the additional resistor circuit is shown in dash lines. It is usually necessary to drill a hole in the base of the directional relay to connect this circuit.

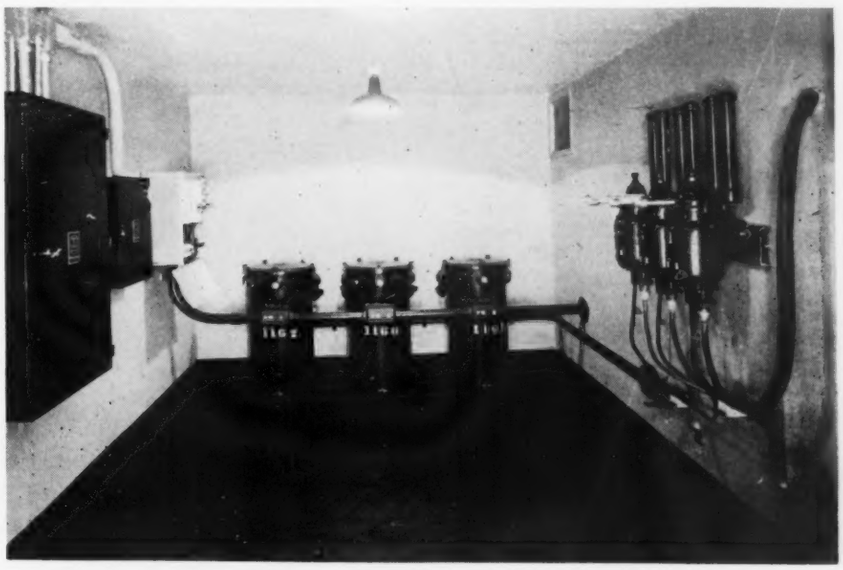
•

Vault Designed as a Network Nucleus

At the headquarters office of the Fitchburg (Mass.) Gas & Electric Light Company provision has recently been made for the nucleus of a future network by allocating a basement room 10 ft. long x 15 ft. wide x 8 ft. 6 in. high for substation facilities serving the building with the customary 120/208-volt supply through three single-phase, 25-kva. G. E. delta-Y transformers energized from an incoming 2,300-volt primary.

Space has been set apart on one wall for three gang-operated G & W 2,300-volt, oil-filled fuses attached to the wall by a 6.5-in. channel iron, the incoming feeder legs being carried on Line Material cable hangers. From these fuses the primary circuit is carried along the wall in $1\frac{3}{4}$-in. conduit to the transformer bank, safeguarding the connections by entering at the rear.

The secondary circuit is carried in $2\frac{3}{4}$-in. conduit (one end of which is seated in the wall at the right) to an Anchor Electric metering and test cabinet and thence to distribution cabinets serving the building with its



UTILITY office basement affords facilities for initial network equipment

extensive lighting, heating and power displays and applications. Two 1,000-watt lamps in RLM dome reflectors illuminate the vault, which is provided with drainage and ventilating facilities.

The compactness of the design and its adaptability to future equipment modifications or additions, combined with its fireproof equipment, insure maximum service convenience for present and later use.

•

Portable Substation Used on Change-Over

By C. B. MILLER
Assistant Manager Charlotte Branch, Duke Power Company

Designed primarily for emergency service, a 100-kva. portable substation has proved of value in changing over some customers from three-phase power and three-wire lighting to three-phase, four-wire, 120/208-volt service. Use of this substation not only allowed complete freedom of operation in vaults which could be isolated from current but also eliminated Sunday and overtime work in most cases.

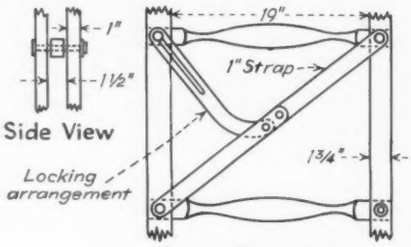
The station contains three 100-kva. standard 2,300 to 120/240-volt distribution transformers connected in delta on the primary and in wye on the secondary. The three secondary phase leads and the neutral are brought out to a panelboard containing seven large lugs. A 150-kva., three-phase booster transformer is so connected that three-phase, three-wire, 240-volt power and three-wire, 120/240-volt lighting or straight three-phase, four-wire, 120/208-volt service can be obtained. This makes a very flexible arrangement and permits permanent secondary transformer connections.

Primary leads consist of three No. 4 5,000-volt, 129-strand "Tirex" rubber-covered wire and the secondary leads are 300,000-circ.mil, 1,000-volt, 459-strand rubber-covered "Tirex." When the substation is not in use these cables are carried on a reel, which is divided into separate sections for each cable. This reel can be turned by a removable hand crank fitted into the reel shaft on the outside of the station.

Four ammeters, one in each phase and one in the neutral, are mounted on the panelboard. Thus, a check on the total demand and kilowatt-hour consumption can be had as well as the current in each phase wire and neutral. The secondary leads are brought out through portholes made in a brass plate to eliminate heating due to induction currents. Portholes are square and a small roller is attached to each of the four edges of the holes on the inside of the plate. The cables can thus be threaded through these portholes directly from the reel and quickly pulled out, with no friction or excessive wear on the cables. The station is wired with both interior working lights and outside marking and danger lights. Interior lights can also be operated from a battery circuit.

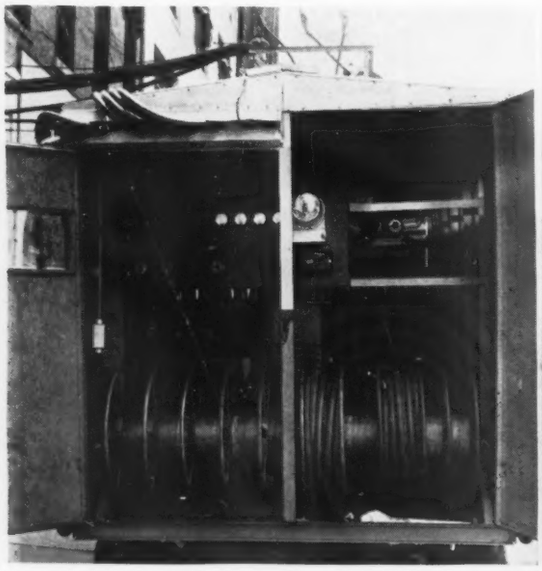
When the substation is in use one end of the primary cables is connected to the pole or other source of supply and the other attached to three leads brought out through per-

Collapsible Ladder for Trouble Trucks



Rungs Turned from 1½" Square Stock

Trouble trucks of the Dallas Power & Light Company carry as standard equipment a special light-weight, collapsible, 12-ft. ladder, for reaching house service racks and other low points. The ladder is used for such duty in preference to the more unwieldy extension ladder, which usually required two men to unlimber and place. The much lighter collapsible ladder can easily be handled by one man.



EMERGENCY SUBSTATION also proves useful in serving customers on change-over from three-phase power and three-phase lighting to three-phase, four-wire, 120/208-volt service

FEATURES AT NO EXTRA COST

Make Your Transformer Dollars Go Farther!

Six extra value features at no extra cost! Six big reasons why we sincerely believe you get more for your money when you buy the new Allis-Chalmers Distribution Transformer.

But we want you to decide that for yourself!

Inspect the big cadmium-plated 3-Way Terminals that take either aluminum or copper leads . . . eliminate costly wiring jobs . . . save you man hours. Then run your hand over the triple coat automobile finish of the husky steel tank. It's protected against rust and tested under pressure to eliminate oil leakage.

Take off the cover and check the core and coil construction. New perfection there is the result of more than 40 years of building distribution transformers for utilities all over the world. And all the windings are double insulated to give you *added* safety . . . *double* protection against winding failure.

Don't miss the extra heavy bushings with liberal creepage! They give you maximum reliability under adverse operating conditions . . . eliminate excessive voltage stresses and corona . . . reduce radio interference to a new low!

And here's the clincher! You get the new Allis-Chalmers Distribution Transformer . . . with all its extra value features . . . at a cost that's no more than you pay for ordinary transformers!

For the inside facts on all the other money saving features you get in the new Allis-Chalmers Distribution Transformer . . . call the district office near you. Or write for new Bulletin B-6096, Pittsburgh Works, Allis-Chalmers.

A-1263

SEE HOW THE NEW 3-WAY TERMINAL WORKS! First and second pictures show how simply and easily leads can be brought to the transformer from both top and bottom. But you don't stop there! For the third picture illustrates an ***extra*** advantage you get with no other terminal! If necessary, leads can be brought straight out from the transformer, without making an extra bend in the conductors or complicating the wiring job. Notice how the tightening tool travels in an ***up and down*** direction eliminating the chance for accidental shorts across the secondary terminals. Notice, too, that a standard lineman's wrench is used. No special tools are needed. You don't have to buy extra fittings. Heavy cadmium plating of the 3-Way Terminal makes it possible to be used with ***both*** copper and aluminum conductors with a minimum of electrolytic action.

TRANSFORMERS *Cut Operating Costs*

manently connected roof-type insulators protected by a rubber shield. Slack in the leads is taken up with cable clamps attached to a square steel tower built on the roof of the substation. (A square tower allows a pull-off in any direction.) Primary leads are carried through an oil switch mounted in the primary end of the station to the primary leads of the transformers.

The station is of welded and riveted construction; the only wood used is in the runners serving as a catwalk on each side of the transformers and in the reel drum. The chassis was formerly used as a large heavy-duty freight trailer, shortened by cutting a section out of the middle and welding together. Construction was by men regularly employed in the Duke Power bus garage shop; wiring and transformer installation was by men in the substation department. The station is fitted with a hand emergency brake. Windows are provided in both ends, so that if necessary an operator can use it while it is being towed into position.

•

Cable Strung for Winter Reliability

By H. E. JUNG

Distribution Engineer
Southern California Edison Company, Ltd.
Los Angeles, Calif.

Winter brings heavy snows in the vicinity of Big Creek No. 1 hydro plant on the Southern California Edison Company system. Successfully withstanding such snows this winter was a new control line, which extends 6,800 ft. from the plant to the headworks.

It consists of a 16-conductor, steel-armored cable, which was strung on an existing pole line and which replaces an obsolete, troublesome, lead-covered control cable which tided the plant through the preceding season.

Design is for 1½ in. of ice plus 1-lb. wind, for both messenger and cable. A $\frac{7}{16}$-in. guy strand is used for messenger, while special $\frac{5}{8}$-in. zinc straps, spaced at not more than 3 ft., replace the usual cable rings.

Maximum span is 140 ft. and the messenger is dead-ended every eight spans on the incline. It also is false dead-ended at every intervening line guy or at every four spans. This is done by wrapping an additional turn of guy strand around the pole and clamping it to the through messenger on each side of the pole.

Grade clamps are fixed to the cable 2½ ft. from the pole both ways, and in addition there is a minimum of two intervening grade clamps per span.

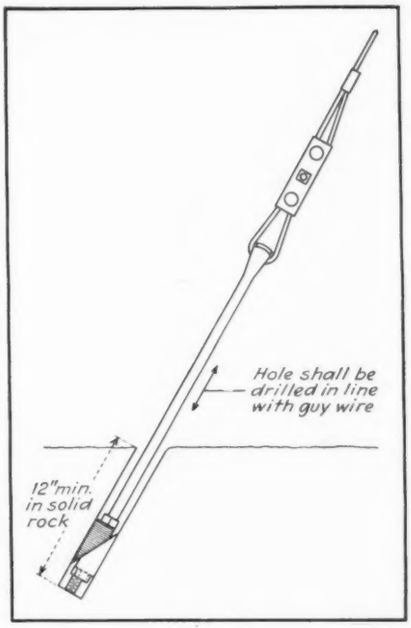
Power is carried above, and minimum clearance to the control cable is 8 ft.

The cable, weighing 2.479 lb. per foot, consists of fourteen conductors of seven-strand No. 12, and one pair of No. 16 solid telephone wire, and is armored with No. 10 B.W.G. galvanized wire.

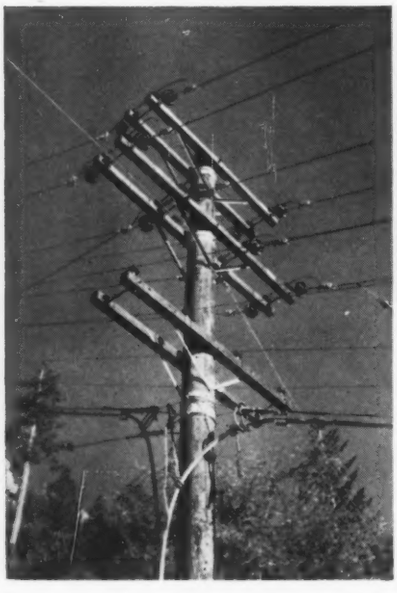
Instead of being spliced, the lengths (maximum 1,690 ft.) were terminated at metal-inclosed, pole-mounted terminal blocks, as shown in the accompanying illustration. While they cost somewhat more than splices, it is felt these will justify themselves by facilitating testing and repair and by eliminating the hazard of a leaking splice.

•

Anchor Installation in Solid Rock



West Penn Power Company's distribution specifications for installation of anchor in solid rock require a 2 x 30-in. expanding type rock anchor. A hole 2 x 20 in. is drilled in the rock, expanding anchor by twisting the anchor rod with a bar inserted at the eye. The anchor is seated firmly before attaching guy wire. If thickness of earth covering does not permit the use of a 30-in. rock anchor a hole is blasted for use of a 12-in. cone anchor, the hole to be at least 42 in. deep with 24-in. in rock.



CONTROL CABLE strung under existing power and telephone lines. Messenger is dead-ended and cable sections terminate as well, ready to be connected through terminal block (left)

TERMINAL BLOCK (metal cover removed) used instead of splice (right)

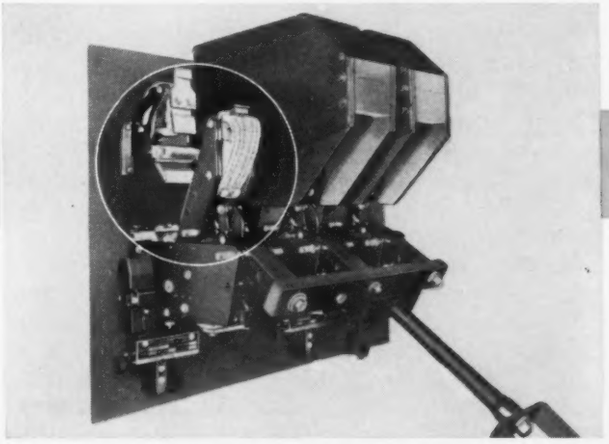
FOUR-BOLT suspension clamp on incline; on each side, 2½ ft. from pole, are grade clamps (above)

urn into REPEAT BUYERS

Like many another electrical manufacturer, Roller-Smith is enjoying a banner year. Some of this increase is due to the pick-up in business conditions. But, a greater portion can be traced to the acceptance, by power companies and industrial concerns of recent Roller-Smith developments and improvements—a few of which are shown on these pages.

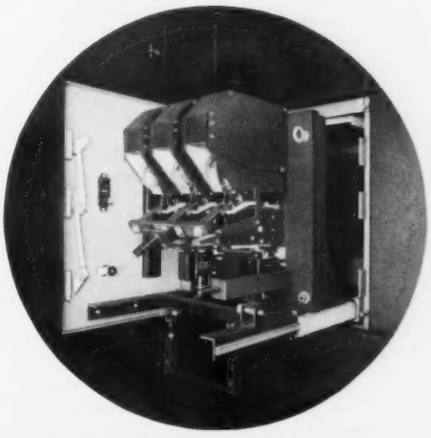
Today Roller-Smith is in a better position than ever before to handle orders promptly and efficiently. New production facilities . . . increased manufacturing space . . . and greater inventories have made this possible.

Get complete data on Roller-Smith equipment. Judge for yourself why new customers have been converted into repeat buyers. The coupon is for your convenience.



4 AIR CIRCUIT BREAKERS—A complete line, including a new design for 15,000 and 25,000 ampere interrupting ratings. Other breakers available up to 6000 amperes at 600 volts A.C. and 10,000 amperes at 750 volts D.C. Live front, dead front and steel enclosed designs for manual or electrical operation.

5 WEATHERPROOF OIL BREAKERS—Non-automatic for either pole or wall mounting, 200 and 400 ampere capacity at 7500 volts. Utilizes inverted contact design; is completely weatherproof and can be equipped for remote operation from the ground.



6 INSTRUMENTS — Newly designed switchboard instruments are available with lower burdens, greater readability, and sustained accuracy over a wider range of frequency, temperature and wave form than previous designs. Mechanically constructed to withstand salt atmospheres, vibration, etc.

7 DRAWOUT AIR CIRCUIT BREAKER SWITCHGEAR—Built with such features as the telescoping rail, which permits the circuit breaker to be run in or rolled out like a file drawer, these units are installed in central stations, Navy Yards and industrial plants. With this construction breakers can be withdrawn without resorting to handling devices . . . and there are no separate rail extensions to put into place.

Electrical Measuring and Protective Apparatus

ROLLER-SMITH COMPANY BETHLEHEM, PENNA.

Switchboards • Metal Enclosed Switchgear • Electrical Instruments
Indoor and Outdoor Oil Circuit Breakers • Air Circuit Breakers

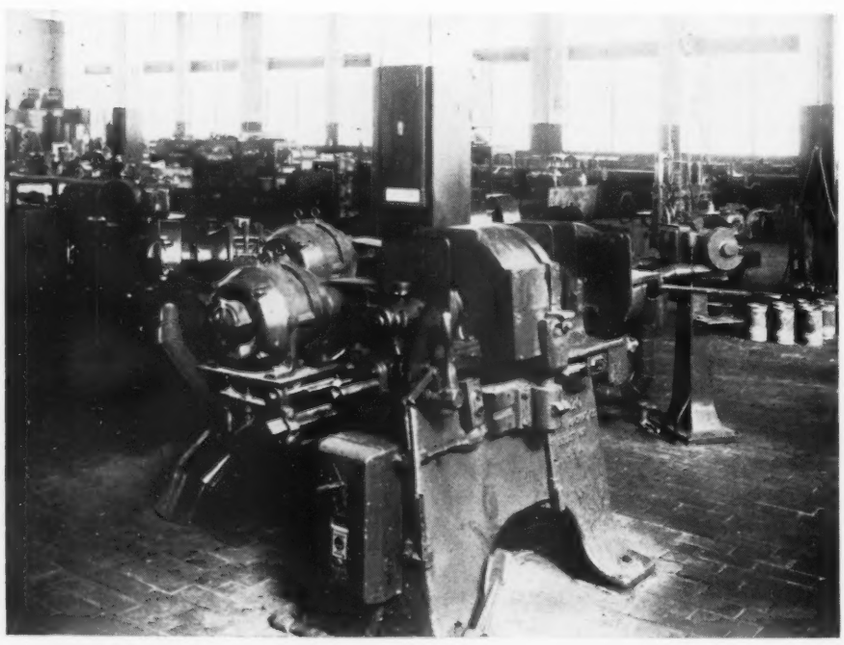
INDUSTRIAL ENGINEERING

Wiring Economy in Grinder Drives

In a Massachusetts maintenance shop four grinding units were recently mobilized in an area 19 ft. 8 in. long x 9 ft. wide, diagonal mounting of machines and motors insuring advantageous use of the available space and minimizing wiring material from a supply at a central point near the floor. All four machines are served by a three-phase, 550-volt feed carried in 1-in. conduit from an overhead junction box at the top of a shop column above the group center to a terminal box about 1 ft. above the floor, whence the individual units are fed by independent conduit lines under the surface or flush with it as conditions permit.

The units consist of (a) a No. 120 Gardner grinder with three 18-in. diameter wheels, two driven by a 5-hp. Cleveland motor and the third by a separate motor of the same make and rating; (b) a U. S. Electric Tool double grinder with 8-in. wheels and 3-hp. motors; (c) a Fay & Egan 9-in. diameter double grinder with "Superior" motor; and (d) a Cincinnati double grinder with 6-in. wheels driven by a ½-hp. motor. All motors are provided with across-the-line starters, and in general short "BX" connections are made between the starters and the motor frames as a result of the mounting of the controls close to the operators' positions.

All these units were arranged for flexible service through the use of individual motor drives without line shafting or exterior belts encroaching upon production space. With self-contained equipment of this type the group can be made to function as a single production unit, all exhaust piping being centralized for delivery to a 12-in. trunk line, and controls with motors being accessible for operating convenience and inspection.



COMPACT grinder layout contributes to wiring economy

•

Collector Rings for High Voltage

Slip rings for 11-kv. contacts are hardly practicable for motors or generators, but for a pay-out and take-up cable reel they are not unreasonable. At any rate a slip-ring set up is handling that duty quite satisfactorily on a dredge which is now working on the relocation of the famous Columbia River Highway between Portland, Ore., and Bonneville Dam.

Service is by a submarine cable which is taken up and paid out by a reel on a substation barge which accompanies the dredge as it moves along the river. The collector rings are used for connection from the reel to the transformer primaries and are mounted on an extension of the steel reel shaft.

This shaft is 5 in. in diameter, and just outside of the reel it carries a collar which constitutes the bearing on that end, with three holes bored through it parallel to the shaft and 120 deg. apart. The individual conductors from the inner end of the cable are carried through these holes and along the shaft, one being connected to each of the collector rings.

The rings are of copper strip about ½ in. in thickness and are mounted on the shaft extension by three insulators each, as shown. These rings are approximately 30 in. in diameter and of course turn with the shaft. Current is picked up from the rings with brushes and passes through oil

HOOSIER SIGNIFIES

Dependability

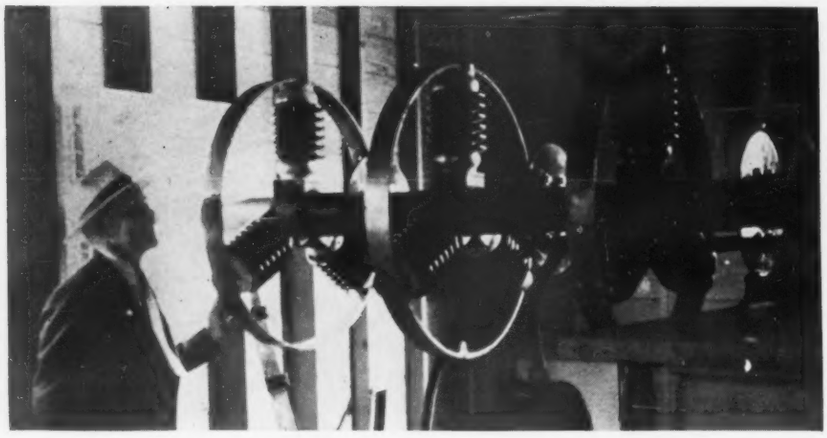
. . . in every phase of transmission line erection. HOOSIER'S competent personnel and specialized equipment, collaborating with your own supervisory force, assure dependable construction . . . at a saving. Choose Hoosier and be *sure* of well-built transmission lines *at lower cost!*

HOOSIER ENGINEERING COMPANY

CHICAGO — 46 SO. FIFTH ST., COLUMBUS, OHIO — NEW YORK

Canadian Hoosier Engineering Company, Ltd., Montreal, Canada.

ERECTORS OF TRANSMISSION LINES



SLIP RING connections for dredge

circuit breakers to the transformer windings. Use of collector rings for taking off current at such high voltage might at first be questioned until it is remembered that they are not revolving except when reeling up cable, at which time the pump is not operating, so there is no heavy load when the rings are in motion.

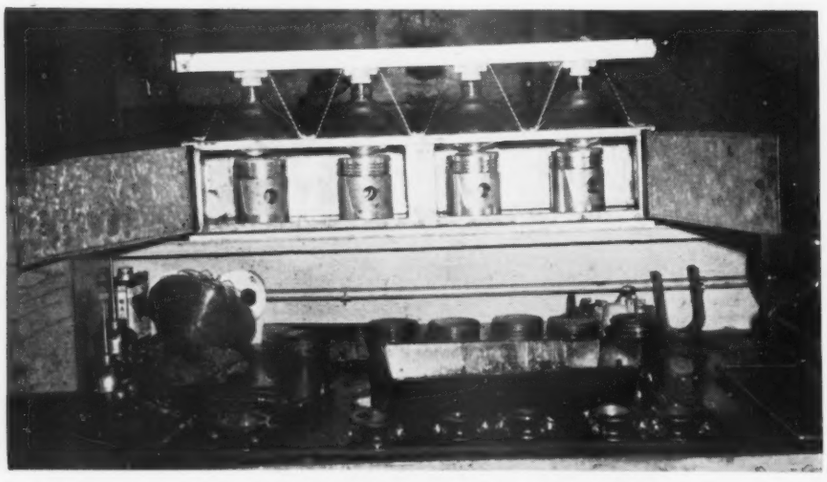
•

Infra-Red for Expanding Pistons

At the several motor truck service departments of the International Harvester Company in Chicago infra-red heat has taken over the job of expanding aluminum-alloy pistons so that wrist-pins can be inserted easily. Before the advent of radiant heat, truck engine pistons were immersed in baths of hot (160 deg. more or less) water for fifteen to twenty minutes to secure the necessary expansion. Because the water cooled rapidly, making several changes necessary, it was a messy and tedious task.

Under four 260-watt infra-red lamps, in 8¼-in. Alzak reflectors, mounted rim to rim, the job is now done in five to seven minutes. In one of the service departments a sheet metal oven-like inclosure has been constructed to house the pistons. Holes for the reflector rims are provided in the top of the "oven," which is 34 in. wide, 6½ in. high and 9½ in. deep outside. Access is by double doors in the front.

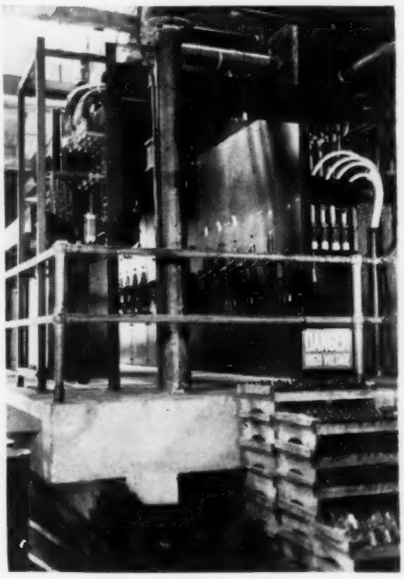
The largest piston that can be heated in this compartment is 5 in. high. A piston of this size just fits between the floor of the chamber and the lamp, with perhaps ½ in. to spare. In another service department the lamp bank is mounted behind a wooden tool rack and is accessible through a hinged door. In both cases, however, the lamps are mounted 6½ in. from the base on which the pistons are supported.



INFRA-RED OVEN for expanding aluminum-alloy pistons preparatory to inserting wrist-pins

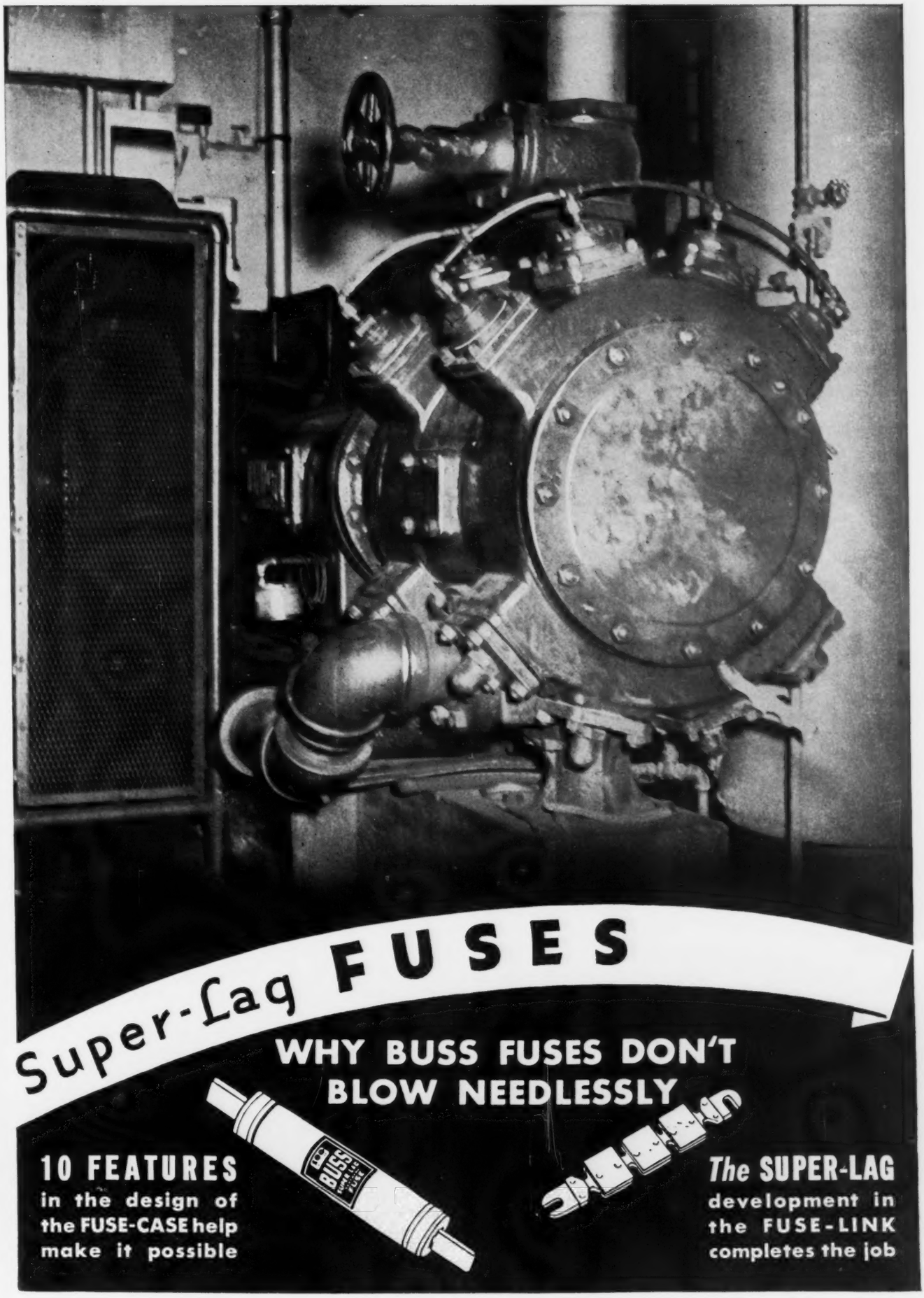
Industrial Switchboard Flood-Protected

In modernizing its interior power distribution supply after a flood on the Connecticut River the Colt's Patent Fire Arms Manufacturing Company, Hartford, relocated a number of control switchboards in various parts of the factory at points well above anticipated future high water levels, and at the same time separated this equipment as much as feasible from production line areas. In the case illustrated the equipment was installed on a 14 x 20-ft. reinforced concrete platform 5 in. thick at a grade about 16 ft. above the basement floor where such control facilities previously were.



SWITCHBOARD and capacitor equipment isolated against high water

Besides an eight-panel switchboard controlling 220-volt, two-phase power feeders and 110-volt lighting service, the platform carries two auto-transformers (220 to 440 volts) and 540 kva. in capacitors, with the necessary metal-clad wiring layout and control facilities. Space was saved by using 460-volt capacitors, and the installation enables the company to eliminate a 3,000-watt I^2R loss in the auto-transformers between 6 p.m. and 6:45 a.m., by cutting these units out of service at night. In the plant as a whole are 1,080 kva. in capacitors and a 125-hp. synchronous motor, resulting in a power-factor increase of from about 70 per cent to 90 per cent under normal loading.


Super-Lag FUSES
WHY BUSS FUSES DON'T
BLOW NEEDLESSLY
10 FEATURES
in the design of
the FUSE-CASE help
make it possible
BUSS
The SUPER-LAG
development in
the FUSE-LINK
completes the job

NEW ENGINEERING IDEAS

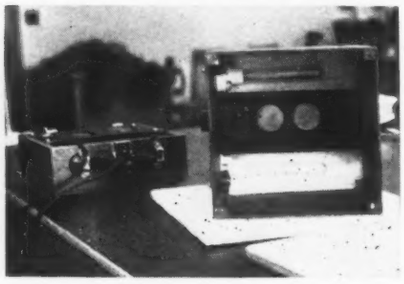
Helps Measure Reflection Factors

By LADNER V. ROSS
Washington Water Power Company, Spokane

A very simple device for measuring reflection factors of wall materials and other illumination surfaces involved in a lighting job has been worked out by lighting engineers at Washington Water Power Company. It employs a photocell to compare the reflection from a surface of known reflection factor with that from the surface being measured. The device consists simply of a box, the bottom of which is open. This open side is placed over the surface to be measured and the surface thus becomes the inside bottom of the box to close it completely. The photocell is in the top of the box and near the top are two lights to illuminate the surface being measured. Output of the photocell is measured with a separate meter.

By determining the meter readings which correspond to various reflection factors for various intensities of the lights within the box it becomes possible to take readings quickly. The measurement is made by taking a reading on the surface of known factor and then immediately taking a reading on the unknown surface. Using this procedure in connection with data previously obtained makes it unnecessary to correct the voltage input to the lights within the box and hence makes it possible to obtain accurate readings with whatever working voltage happens to be at hand.

Readings have been found to be accurate to within 1 per cent and the device has proved very useful in planning illumination jobs.



EASY TO CARRY, the equipment is in two parts—the box which is placed over the sample and plugged into standard voltage; the meter for measuring the photocell output

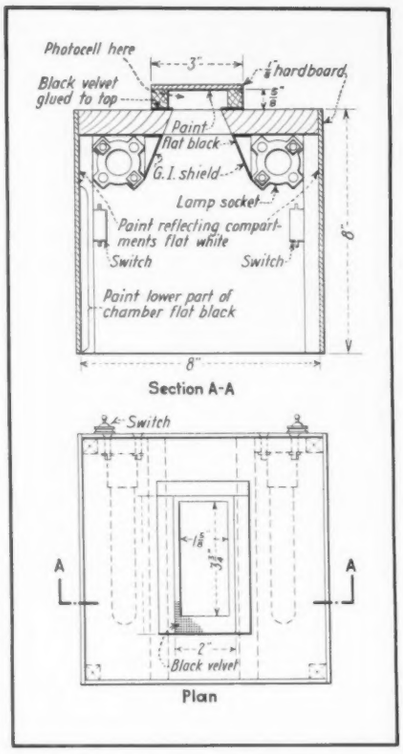


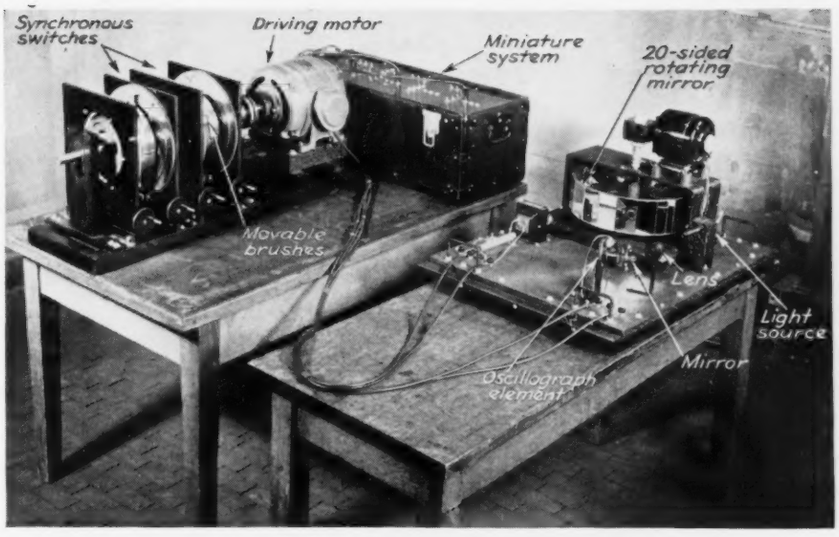
DIAGRAM of the box; the photocell is slid into the compartment at the top; the two lamps in box are T-6½, 25 watt

Portable Equipment Analyzes Transients

In extending the use of the alternating-current network calculator from the study of steady-state conditions to the analysis of transients the Westinghouse Electric & Manufacturing Company sets up the power system under investigation in miniature on the calculator, using reactors, resistors and capacitors in combinations representing the circuit constants. System faults and switching operations are simulated by the use of special synchronous switches, and a cathode-ray oscilloscope is then employed to measure or record the transient currents and voltages. Such apparatus, according to R. L. Witzke, central station engineer of the company, is proving invaluable in making studies where mathematical calculations are impractical, if not indeed impossible. Recently the company has developed portable equipment for demonstrating fundamental phenomena related to transients to interested audiences.

A power system in miniature is set up in a trunk, using the same type of resistors, reactors and capacitors employed in the network calculator. While most power system studies made in the laboratory are carried out on a three-phase miniature system, a single-phase representation is used in the demonstrating equipment here illustrated. This decreases the weight of the portable equipment without impairing the demonstration.

The apparatus consists, in addition to a light source, lens and oscillographic element, of a 20-sided rotating mirror, screen and a set of motor-driven synchronous switches



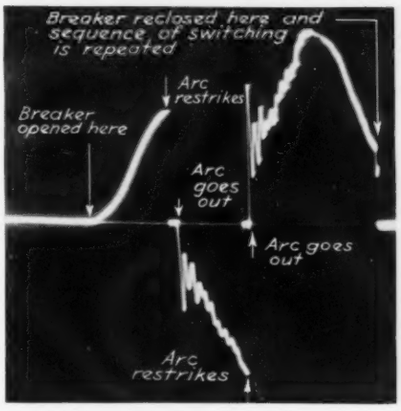
PORTABLE APPARATUS for demonstrating power system transients

provided with closely adjustable movable brushes. For simulating faults the switches are connected between line and ground or from line to line on the miniature system, depending on the type of fault being demonstrated. To study switching operations the switch is used to simulate circuit breaker operation.

Each element of the synchronous switch consists essentially of a conducting and an insulating segment on a drum and two movable brushes, one for controlling the point of fault application and the other the point of fault removal. Each brush is located on a separate brass ring which can be rotated by a worm gear. A very fine adjustment results from the fact that one revolution of the worm changes the point of fault application or removal approximately seven electrical degrees based on a 60-cycle wave.

In the laboratory a cathode-ray oscilloscope is used to measure the transient voltages, but this type of measuring device is unsatisfactory for demonstrations except before very small audiences. For this reason a special measuring device was designed for the portable equipment, which projects the transient upon a large screen. In this set-up a pencil of light from the source is directed by a lens upon the mirror of a special magnetic oscillograph element and is thence reflected upon the rotating mirror and then upon the screen. The magnetic oscillograph element moves the spot vertically on the screen, the movement being proportional to the voltage being measured. The rotating mirror, acting as a sweep, moves the spot horizontally across the screen. The oscillograph element and the rotating mirror, acting together, trace the complete transient on the screen. As the transient is repeated 20 times per second, the effect of a standing wave is produced on the screen. This makes possible examination at leisure of a transient which lasts only a fraction of a second.

With this equipment it is entirely feasible to demonstrate a variety of phenomena associated with transients, faults, recovery voltages, grounds and switching surges. In a typical demonstration this portable equipment showed: (1) Effect of varying the source reactance of the miniature system upon the recovery voltage; (2) effect of varying line length (by varying capacitance of miniature system) upon recovery voltage; (3) how recovery voltage affects the operation of a de-ion protector tube; (4) how restriking in a breaker can build up high voltages on a system; (5) effect of system grounding device on overvoltages caused by switching surges—(a) reactance grounding can produce high voltages under some conditions; (b) resistance grounding will not produce high voltages during switching.



OSCILLOGRAM of voltage variations across a circuit breaker when disconnecting a line subjected to a single line-to-ground fault

The breaker was represented by synchronous switches and the arc in the breaker was assumed to restrike twice before finally closing the circuit. The transient was repeated 20 times per second and in recording the film (in this case made in the laboratory) was exposed 20 seconds. The oscillogram therefore contains 400 traces of the transient, but this appears as a single trace because the transient repeats accurately each time. Oscillograms like this are readily shown on the screen when using the portable equipment.

Conductive Rubber Has Electrical Uses

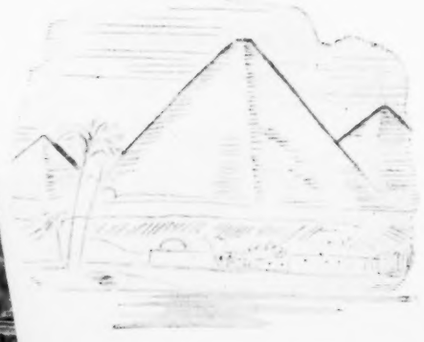
Electrically conductive rubbers, for use where a flexible and elastic conductor is required, or where the normal insulating properties of rubber are a disadvantage under particular circumstances, have been marketed recently. Potential uses are seen to include those applications especially where current leakage or static charges require grounding to prevent fires or explosions and, more specifically, cable insulation.

Previously available semi-conductive rubber materials—formed by compounding heavily with such materials as powdered charcoal, graphite or lamp black—have achieved conducting power at the expense of mechanical properties. A new technique, however, developed at the laboratories of the Dunlop Tire & Rubber Corporation, Buffalo, N. Y., permits the production of electrically conductive rubbers without sacrifice of the normal properties of flexibility and resistance to cracking or wear.

Rubber with good mechanical properties is available with any required specific resistance between the limits of one ohm and 10^{15} ohms —this latter value being the approximate specific resistance of pure rubber—and of a hardness which can be varied from that of ebonite to that of a medium soft rubber. Within certain limits, any degree of conductivity can be associated with any degree of hardness, except that very soft rubbers cannot be made highly conductive.

For Buildings that are "Up to Stay"

King's County Hospital, Main Bldg., N. Y.
CLARK, MACMULLEN and RILEY
Consulting Engrs.
LEROY P. WARD, *Architect*

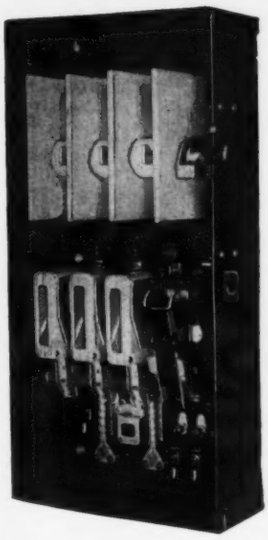


King's County Hospital Nurses' Home, N. Y.
SYSKA and HENNESSEY
Consulting Engrs.
LEROY P. WARD, *Architect*

Brooklyn, N. Y. Appellate Court House
AMOS T. SMITH, *Consulting Engr.*
SLEE and BRYSON, *Architects*

they Specify Monitor Controls

City Hospital, Welfare Island, N. Y. Chronic Disease Group
TENNEY and OHMES, *Consulting Engrs.* BUTLER and KOHN, *Architects* and YORK and SAWYER, *Architects*



Monitor
The Original
BALTIMORE, MD.
"JUST PRESS A BUTTON" System

Architects and engineers responsible for the erection and maintenance of truly *permanent* structures are partial to mechanical equipment which has demonstrated an exceptional "life expectancy". So for controlling the operation of pumps, blowers, air-conditioning systems and other motor-driven apparatus in these typical permanent buildings it is only natural that Monitor was selected.

For there's nothing temporary about Monitor Automatic Controls .... From the little ½ HP Starter to the big new 1200 AMP Contactor you'll find that long-lived ruggedness and inbuilt quality characterize every controlling device bearing the name Monitor. Monitor field engineers in all important cities stand ready to assist you in selecting the most efficient control for your requirements. Consult your phone book or write:

MonitorControllerCompany

Gay, Lombard & Frederick Sts.
BALTIMORE, MARYLAND

LOAD BUILDING

Fluorescent Kit Weighs Only 30 Lb.

By CARL FISHER

Illuminating Engineer Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

The rapidly growing interest of many of our customers in the use and application of fluorescent lighting has made it highly desirable for utility companies to inform the people as to this popular new style of lighting.

It is one thing to go to these people with folders and booklets and charts, but we found that everybody likes gadgets and likes to see things rather than just be told about them. As ever, "seeing is believing."

It was for these reasons that we developed a fluorescent demonstration kit which was portable, compact and light-weight which we could take out to the customers and use at lectures so the people could see for themselves.

The kit when closed is a leather-covered 20x14x10 suitcase, handle and all, weighing only 30 lb. Unpacked however, as shown in the accompanying illustration, the kit exposes complete material for an incandescent-fluorescent demonstration. Fluorescent tubes may be turned on individually as well as the incandescent lamps. One pair of tubes is on individual low power factor auxiliaries and the other pair is wired to a two-lamp high power factor auxiliary. The auxiliaries are placed back of the reflectors. Wiremold semi-concentrating aluminum reflectors are used, fastened by screws to wood blocks, the sockets being supported by the reflectors.

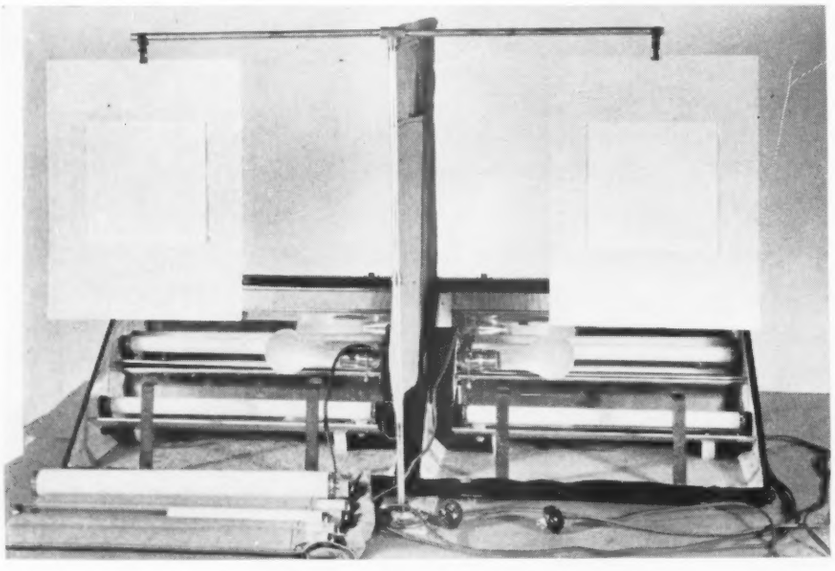
Each half of the case has its own 10-ft. cord for power supply. Cloth pockets are used for extra lamps and are stored in the front part of the case and held by the phosphor bronze clips. One cloth pocket is used as a partition between the two cases so that two like colors mounted on cards may be compared simultaneously under two different lights. The brass tubing forming the support for the cards and partition is taken apart and carried in the front part of one of the cases under the spare lamp kit.

Color Samples

The color samples, two of each, are folded paper napkins mounted on gray bristol board. They are carried between the incandescent lamp and the fluorescent reflectors in each half of the case. Fifteen-watt fluorescent and 100-watt incandescent lamps are used. In the position shown, the level of illumination on the color samples is about 100 ft.-candles. The incandescent lamp sockets are tilted forward slightly so as to permit the bulb to clear the reflectors.

An ammeter can be used to show the increased current necessary for the two F lamps with low power factor auxiliaries. Push-button switches for each fluorescent tube are located on each side of the incandescent socket.

The arrangement shown is only one method of using the case. The halves could be stood on end and back to back to light two objects, one on either side of the table, or they could be turned slightly toward each other so that the maximum candlepower from all four reflectors would play on one object, thus permitting either higher intensities of light to be demonstrated or combinations of tubes to get various color renditions. The kit has been found very useful both for lecture work and customer demonstrations.

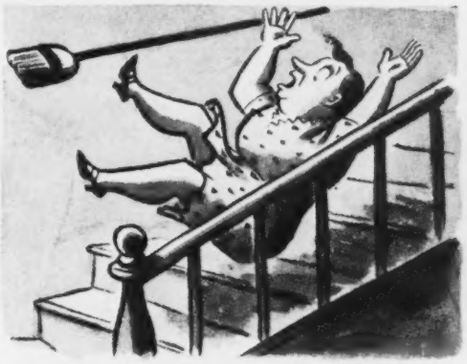


FLUORESCENT-INCANDESCENT demonstration kit used by Consolidated of Baltimore for lecture purposes packs into a 20x14x10-in. plywood suitcase, total weight 30 lb.

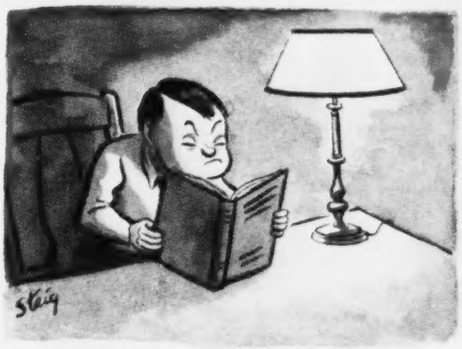
Collier's

How to get yourself talked about
...sprain your wife's ankle
...strain your kid's eyes
...AND SAVE 15¢

1 It's amazing how unpopular you can become through one simple act of bulbsnatching. You start by taking a 25 watt bulb out of the hall and putting it in your reading lamp...



2 The immediate result is you leave the hall in darkness. This has great possibilities, as shown in the sketch above...



3 Next—your small boy tries to study by the light of the snatched bulb and lays the groundwork for a fine case of eyestrain. And all you've saved is the 15¢ a new 100 watt G-E MAZDA lamp would have cost in the first place.

Made to stay brighter longer
75 and 100 watt... 15¢
15 and 25 watt.... 10¢
40, 50, and 60 watt... 15¢
100-200-300 watt... 60¢
G-E MAZDA LAMPS
GENERAL ELECTRIC

4 To avoid all this, simply buy some *spare* G-E MAZDA lamp bulbs. Get *enough* so every reading lamp can total at least 100 watts. They cost less and give more light than ever before! Get some today! Don't be a bulbsnatcher!

SPEAKING OF GETTING TALKED ABOUT, "Bulbsnatching" is fast becoming a household word in your territory—thanks to ads like this running in the Post, Collier's, Liberty, Look, and other national magazines. This kind of copy fills empty sockets because it gets read *all the way through.* General Electric Co., Nela Park, Cleveland, O.

Adequate Wiring in San Antonio

By E. A. GAUTHIER

San Antonio Public Service Company, San Antonio, Tex.

More than eight years ago our company instituted a campaign of contacting builders and homeowners in order to increase the installation of convenience outlets. More than 2,000 of these prospects were contacted and about 1,200 of the so-called extra outlets were actually installed.

During this long period we have learned that it pays to sell the principles of adequate wiring to the journeyman electrician, to contractors' employees, to the man in overalls, if you please. His practical work, his practical dress and his practical approach to wiring give his views a high value in the eyes of home owners, architects and others in the wiring picture.

To impress upon these electricians the significance of adequate wiring we have prepared an electrically lighted visualizer (illustrated), 9x5 ft. Colored lights mark every lighting outlet, switch, convenience and special purpose outlet. First the lighted board shows a conventional inadequate wiring layout. Then in a series of five steps the display is built up to portray in dramatic fashion the modern concept of wiring adequacy.

The display is used on our sales floor and at home shows, club meetings, etc. In five weeks recently owners, architects and contractors brought us 74 wiring plans. Recommendations of our lighting specialists resulted in a 65 per cent increase in installations, from 29 outlets per plan to 47 outlets.

•

Precipitron Clears Rink Atmosphere

A precipitron or air cleaning unit is now used at the Alexandra Skating and Dance Hall, Hamilton, Ontario. In roller skating a chalky substance is spread on the floor to prevent side slipping of the skates. This, in turn, is whipped up into the air, which, with the tobacco smoke, used to make the hall, after an hour or so, anything but a salubrious place.

The owner looked around for a means whereby the dust and smoke nuisance might be eliminated. Mechanical filters were out of the question, because the finest mesh procurable would be entirely unable to trap the smoke particles, which are 625 times smaller than the 1/250,000 in. limit of a 200 mesh screen.

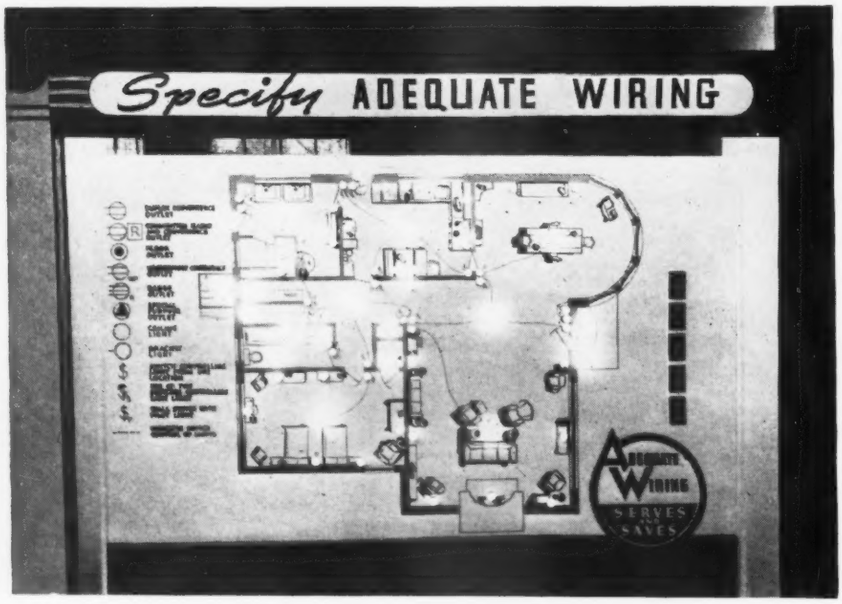
All air within the ventilating system is drawn through a Westinghouse precipitron. As it passes through the leading edge of the precipitron cell all foreign matter in the air, regardless of size, is given a definite electrical charge. As the air passes on into the collector chamber the particles are attracted to alternately positive and negative charged plates to which they adhere. Only clean air passes through the system.

The precipitron equipment is contained in a penthouse especially constructed over the entrance to the rink. A system of duct work takes the clean air from the precipitron and distributes it through the building through ceiling plaques. Both the supply ducts and the return air ducts are inclosed in the ceiling space. Provision has been made so that air may be drawn in from the outside.

The air quantity is 15,000 cfm. and a 5-hp. Westinghouse motor drives a Canadian Sirocco fan with a V belt drive. The air quantity provides a complete change of air every ten minutes.

The precipitron consists of 20 collector cells racked in two tiers of ten cells each. These cells are supplied with a direct-current potential of 13,000 volts to the ionizer section and 6,000 volts to the collector plates. These potentials are supplied by a power pack operating from an ordinary lighting circuit of 110 volts, 25 cycles.

The precipitron equipment in this installation is designed to provide a cleaning efficiency of 85 per cent by the Bureau of Standards blackness test; that is, 85 per cent of all the dust and dirt in the air is removed during its passage through the precipitron. This compares with an efficiency of from 10 to 20 per cent obtained with the ordinary type of air filter. The precipitron is capable of removing dirt particles from the air regardless of size and can remove particles 1/250,000 in. diameter, the size of a tobacco smoke particle.



THIS electrically lighted display is used by San Antonio Public Service to sell adequate wiring to contractors, dealers' employees, customers, home owners and architects. In three colors of lights, the display achieves adequate wiring in five steps

•

Lighting Sales Follow Rewiring

By GEORGE BARKER

Manager Pacific Coast Electrical Bureau, San Francisco

Although rehabilitation wiring is the direct objective of the Pacific Coast Electrical Bureau, in the effort referred to herein, lighting is both the starting point and the end point. Furthermore, adequacy in wiring capacity must be presupposed in

WATCH THE FAVORITE—
WATCH *Frigidaire!*

Watch for announcement of the most spectacular line of refrigerators and electric ranges ever offered to the buying public. Now being introduced to Frigidaire Dealers in factory-conducted meetings from coast to coast. Brilliant new models, new advertising and new selling plans—all strategically designed to increase further the predominant sales leadership of Frigidaire Dealers in '41!

REFRIGERATORS

1. Brilliant New Beauty! A world-famous designer creates for Frigidaire completely new [redacted] refrigerator as a beauty note in your kitchen.

2. More Useful Than Ever! New [redacted] compartments—bigger and roomier! New [redacted] up to [redacted] bigger! [redacted] adjustable to suit your needs. Even the [redacted] model selling for only [redacted] is fully-fitted, including [redacted] and [redacted]!

3. Use Less Current! The [redacted] 1941 Frigidaires have [redacted] power to keep food better and freeze ice faster! Yet they cost less to operate than [redacted].

4. Sensational New Values! Choose from [redacted] brilliant models—every one a [redacted] priced [redacted]. [redacted] Cold-Wall prices are [redacted] as $[redacted]... [redacted] Standard models [redacted]! The [redacted] a genuine Frigidaire "Six," SELLS FOR ONLY ... $[redacted].

ELECTRIC RANGES

1. Brilliant New Beauty! New concepts of range beauty, created by a world-famous designer include [redacted].

2. More Useful—Faster! Exclusive advantages assure [redacted] more care-free cooking. New [redacted] are [redacted] known!

3. Use Less Current! Lowest cooking cost in Frigidaire history. New [redacted] units [redacted] more efficient. Exclusive [redacted] save up to [redacted] on current.

4. Sensational New Values! [redacted] brilliant models. Everyone an outstanding [redacted]! Prices start at only [redacted].

THE SAME *Leadership in Action*

THAT SOLD OVER 600,000 REFRIGERATORS IN 1940

SCORES AGAIN IN '41!

discussing the promotion of better lighting itself. And since this too frequently involves a supposition contrary to fact, the co-ordination of wiring rehabilitation efforts with lighting sales deserves attention in almost every instance where the latter is fundamentally the objective.

The Pacific Coast Electrical Bureau surveyed business properties last year to determine the amount of electrical modernization necessary to bring them up to reasonable standards. As a result, within a one-year period, the managements of 44 properties were induced to spend $513,500 for electrical modernization. Of the remainder, 34 are now considering the expenditure of $305,000 for the same purpose, while 107 buildings remain as good prospects for modernization to the extent of $2,054,500.

Data on Lighting 60 Sansome St., San Francisco

Area lighted	7,138 sq. ft.
Total wattage	28,950 watts
Watts per sq. ft. (total area)	4.05
Watts per sq. ft. (working area)	5.0
Ft.-candles per watt (working area)	9
Average ft.-candles	45
Minimum ft.-candles	40
Maximum ft.-candles	50
Ceiling height, ft., inches	11 ft. 9 in.
Ceiling color, white with tinge of blue	
Wall color, pale green	
Venetian blinds, white metal	
Type of luminaire, luminous indirect using 300-watt silver-bowl lamps	
Spacing of units	8.3x8.5 ft.
Mounting height	9 ft. 3 in.
Lighting and wiring cost per sq. ft.	$0.36

These very respectable figures do not include elevators, paint, hardware, plumbing, glass or anything else except straight electric wiring, fixtures, switchboards, panelboards and wiring devices.

Leading real estate leasing brokers say that light is the second most important consideration in the mind of the average lessor, location usually being the first. This undoubtedly is the reason why experience has so definitely shown that the objective of better lighting must be used as the entering wedge to a discussion of wiring.

An instance of this is the recent lighting job at the No. 60 Sansome Street office building in San Francisco, where a 45-ft.-candle intensity has been provided on 7,138 sq. ft. of floor. Thin wall wire made the installation possible. Without it there would have been no relighting, for circuits were overloaded and the cost of replacing conduit runs was prohibitive.

The bureau's engineer, W. C. Heston, had discussed wiring modernization with the building superintendent at various times during an eight-month period prior to the time the space was leased. When the space was leased to an insurance broker, it was found that refixturing with 300-watt lamps was planned without consideration for wiring, although the utility's lighting specialist had suggested providing wiring capacity for 500-watt lamps and had called attention to the importance of proper lamp voltage.

After going into the matter of wiring adequacy at great length, the bureau's engineer convinced the building owner's representatives that it was decidedly in their interest to have the job refigured on the basis of full adequacy, making use of the new thin wall wire. The difference in wire size increased the efficiency of the lamps by just 10 per cent. An effective illumination job resulted and the means of adding to the lighting as time may require has been provided. Details of the particular job are shown in the accompanying table.

•

Air Conditioning Prevents Rust Loss

Rust, the annual summer plague of manufacturers maintaining stocks of expensive metal parts, has been eliminated as a loss factor by the Imperial Knife Company, Providence, R. I., through an ingenious air-conditioning installation in the stockroom.

Because several million pocket knives are kept in stock, the company suffered substantial losses each summer when moisture condensed out of the air and rusted the highly polished knife blades. Last year executives of the firm ordered two General Electric FD-30 (3 hp.) unit air conditioners and after a full year's operation they report that the rust problem has been completely eliminated and, incidentally, summer comfort provided for stockroom employees.

A unique feature of the installation is the occasional use of a heating coil in summer. This reheat coil operates to prevent over-cooling when the refrigerating machine has a heavy dehumidification load but a light cooling load, as on "cool, clammy" days.

Electric Oven Cuts Auto-Drying Costs

An electrically heated oven for baking an entire automobile has been installed by Boulton Auto Rebuild, Seattle, Wash., and is credited with presenting many advantages, including that of baking the paint on an automobile within an hour's time at a cost of only 50 to 75 cents for electricity. The unit was designed by heating engineers of the Puget Sound Power & Light Company and installed under their supervision.

The heating elements—2-kw. finstrip units totaling 52 kw.—are installed in a compartment at the top. A blower forces air through the compartment, down one side of the oven through an air chamber, from which it is released to the oven proper through the slots which appear in the picture. The air crosses the oven horizontally, leaves through slots on the opposite wall, and part is exhausted, part recirculated.

Along the intake wall is a trough to provide moisture for maintaining high humidity. Temperature control is automatic. Fresh air is filtered before admission. Temperatures run between 120 and 190 deg.F. Total installed cost of the electrical equipment, including blower, was $470.

Operating at the rate of five to eight cars per eight-hour day, the oven uses 5,000 kw.-hr. per month.

CUSTOMER points to one of the openings which admits electrically heated air to automobile oven

Outlets are on opposite wall. Just above customer's hand is trough for providing moisture to maintain humidity. Car is run into oven for drying, which takes only one hour, as compared to 48 hours without oven.

★ FOR BETTER LIVING IN THE AMERICAN WAY ★

THE NEW 1941 Westinghouse REFRIGERATORS

are ready!... with

It's the "DREAM LINE" of 1941—this glamorous new group of COLOR-STYLED Westinghouse Refrigerators! From top to bottom, in every price bracket, there's a model to suit *every* prospect's individual taste.

This new line includes four super-value SIXES . . . two beautiful SEVENS (competitive with most "sixes" displayed by others) . . . and three eye-filling NINE cubic foot models! Popular sizes are available in all-porcelain as well as bonderized Dulux, and there are special models, large and small, to fit every family need.

New Westinghouse models are powered with the famous sealed-in-steel ECONOMIZER mechanism, now quieter and more efficient than ever. Cabinets, frosters and fittings reflect the greatest design achievements in Westinghouse Refrigerator history. And increased production capacity assures an ample supply in 1941 of all popular Westinghouse models.

NEW COLOR-STYLING! SELLING FEATURES!

NEW INCREASED CAPACITY! "STEP-UP" PRICING!

NEW OPPORTUNITIES FOR SALES AND PROFIT!

SELL THE DIFFERENT REFRIGERATOR WITH *EXCLUSIVE* TRUE-TEMP CONTROL

Only Westinghouse has TRUE-TEMP CONTROL—a PLUS value that gives users SUPER MARKET Food Protection. A giant advertising and promotional campaign will put this advantage to work for YOU in the public mind. Don't miss out on the extra profits it brings. Call your distributor or write direct for complete details.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
DEPARTMENT 1022 MANSFIELD, OHIO

SEE YOUR LOCAL SHOWING of the COMPLETE LINE

Ask your distributor for the time and place of your complete local Westinghouse showing. See it—get all the facts.

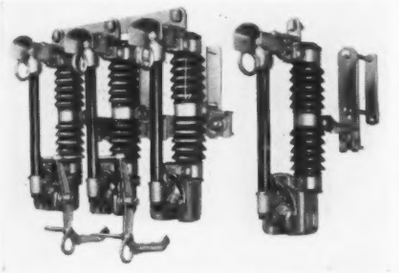
WESTINGHOUSE W

STEP IT UP with Westinghouse in '41

NEW EQUIPMENT

Cutouts

Designed for light- and medium-duty service on distribution lines and substations operating at 2,300 to 13,200 volts, new cutouts provide for complete and positive separation of the arcing terminals. Flexible cable of link is pulled straight out of tube to clear arcs quickly, even with low fault currents. Toggle action releases and drops fuse tube open after fault is cleared. Reclosers are made up of two or three single cutouts with addition of automatic circuit-reclosing parts. Thus it is possible to convert a single cutout into a two- or three-shot recloser.



Type "STD" and "RTD" cutouts and reclosers; furnished for three voltages: 5,000, 7,500/12,500 and 15,000; fuse tubes rated at 100 amp., may be fused with universal links. **Schweitzer & Conrad, Inc.**, Chicago, Ill.

•

Interference Locator

Designed for the location and isolation of radio interference, this device operates from self-contained batteries or directly from 115-volt a.c. or d.c. lines. Tuning ranges selected by a switch are 500 to 1,700 kc.; 1.7 to 5 mc. and 15 to 32 mc. Sensitivity is such that an input signal of less than two microvolts will produce a deflection of 10 per cent on the output meter scale, it is claimed. Besides a loudspeaker unit, the device is equipped with a two-range calibrated output meter and headphones may be attached in locations where high extraneous noise levels exist. Calibrated volume control may be used with output meter to measure interference suppression devices.

"IL-2" Interference Locator. **Sprague Products Co.**, North Adams, Mass.

•

Oxygen Recorder

Oxygen recorder; measures oxygen concentrations from 0 to 20.8 per cent. **Mine Safety Appliances Co.**, Pittsburgh, Pa.

Oxygen content of process gases, excess air in products of combustion or air in gas transmission systems may be measured and recorded with this instrument, completely assembled on a steel panel. Small diaphragm-type pump circulates solution through the absorption tower of the caustic scrubber, which can be used to remove carbon dioxide and other acid gases. Similar pump provides continuous recirculation of the electrolyte through the analysis cell. Both pumps are driven by ¼-hp. explosion-proof motor which also revolves positive electrode in the analysis cell. All 110-volt conductors and electrical parts are inclosed in explosion-proof fittings.

•

Ammeter

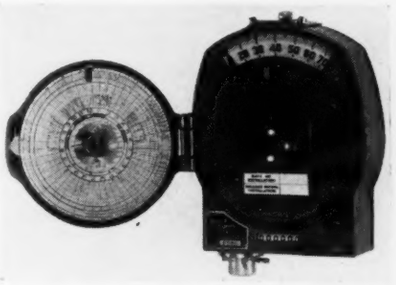
Series "J" multi-range ammeter; meter accuracy 2 per cent. **Precision Apparatus Co.**, 647 Kent Ave., Brooklyn, N. Y.

Multi-range a.c. ammeter can be used on line frequencies from 25 to 60 cycles; 300 milliamp. full scale to 60 amp., eight a.c. current ranges, with a special red correction scale for direct reading on 25-cycle service. Used in combination with the company's multi-range testers, an all-purpose a.c.-d.c. industrial type circuit analyzer is provided.

BUYING ELECTRICAL EQUIPMENT?—"Electrical World" *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Truck Checker

With applications for utility truck operators, a new instrument combines a recording speedometer and clock and provides a graphic chart of the time of operation, the speed in miles per hour, the distance driven and a number of other factors entering into truck operation. In case of accident, the chart will provide evidence of the time and speed of the truck.



"Tachograph," with door open and chart in place. **Sangamo Electric Co.**, Springfield, Ill.

•

"Calling All Cars"

A new control device for utility companies with fleets of radio-equipped service and maintenance cars makes it possible to call any one car or group of cars without disturbing the other receivers in the same system. Equipment consists of transmitter coding unit assembled on standard speech input rack and receiver decoding units similar in size and appearance to ordinary mobile receivers. Control panel of trans-

Control units for RCA Selective Calling Equipment; mobile decoding unit operates from six volts d.c. and requires about 15 milliamp. at 200 volts from receiver power supply during times of signal transmission and two milliamps on stand-by, Emergency Communication Section, **RCA Mfg. Co.**, Camden, N. J.

–AND SILVERY SPANGLED GALVANIZING DOES NOT ALWAYS CONVEY

THE "INSIDE STORY" OF WHAT LIES BENEATH. IF YOU ARE LOOKING AT HUBBARD HARDWARE YOU MAY BE SURE THAT THE HEAVY, EXTERIOR COATING OF ZINC COVERS ONLY THE BEST GRADE OF NEW OPEN HEARTH STEEL, HELD TO RIGID SPECIFICATIONS, CAREFULLY INSPECTED, TESTED AND FABRICATED.

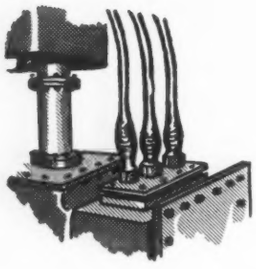
HUBBARD AND COMPANY

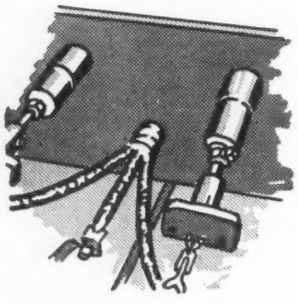
PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

"HANG THE LOAD ON HUBBARD HARDWARE"

OIL STOP

FOR OILTIGHT CONNECTIONS AND SPLICES





● Oil Stop is suited to a wide variety of applications and has been used throughout the electrical industry for cable splicing, low cost oiltight terminals, stop joints, insulating buses, cementing transformer gaskets, repairing cracked bushings, coil sealing, waterproof coatings, etc.

Oil Stop is a phenol-formaldehyde synthetic resin applied as a liquid, which polymerizes at ordinary temperatures whether exposed to air or not, into a firm, enduring, infusible insulation. Free of solvents, no vapor pockets are formed during polymerization. Since there are no vapor pockets, Oil Stop can be used safely within the body of built-up insulation. It seals completely against any kind of oil or water—and will adhere to rubber and oil-impregnated paper.

Oil Stop is flame-resistant, *will not melt or soften after setting*, and is not affected by acid and alkali solutions. Its electrical properties of dielectric strength, dielectric constant and power factor are extremely favorable.

Complete information regarding this unusual insulation will be sent upon request.

IRVINGTON VARNISH & INSULATOR CO.

IRVINGTON, NEW JERSEY, U. S. A.

PLANTS AT IRVINGTON, N. J. and HAMILTON, CANADA

Representatives in 20 Principal Cities

mitter coding units has two rows of eight buttons from which as many as 200 different combinations of numbers can be used.

•

Disconnecting Switch

Designed for application in explosive and corrosive atmospheres, this oil-immersed disconnecting switch is offered for use indoors or outdoors as an isolating device for oil circuit breakers or motor

Type "SF-1" disconnecting switch, with tank removed, contacts closed; inclosed triple-pole, single-throw, group-operated switch in 5,000-volt, 600-amp. rating. **General Electric Co.**, Schenectady, N. Y.

starters in oil refineries, grain elevators, chemical plants and similar applications. All terminals and connections are at least six inches under oil; double-break contacts with ample clearances are used. Operating lever may be locked either open or closed; an interlock prevents opening of the switch under short circuit or load. Operating shaft assembly is designed so that it will withstand more torque than one man can apply on the operating lever without the use of an extension lever. Line contacts are silver-to-silver.

•

Lubricating Oil

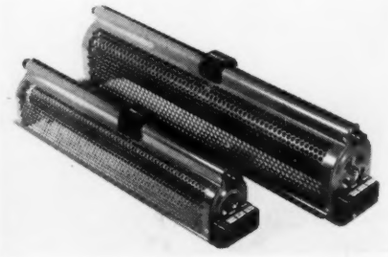
"Superfine" lubricating oil. **The Davenoil Co.**, 158 Summit St., Newark, N. J.

Prepared for delicate and precise instruments, this lubricating oil will not leave a residue of dirt or sticky gum, it is claimed.

•

Four-Range Rheostats

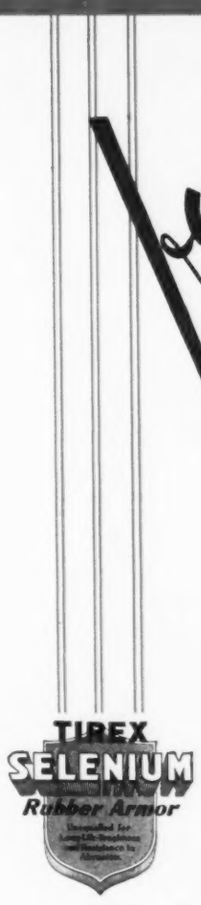
Feature of these new rheostats is that one unit incorporates four different ohmic resistances with corresponding current capacities. Two closely bifilar wound windings, arranged so that each turn of one



Four-range rheostats; type "F3", 350-watt; type "F6", 650-watt. **Rex Rheostat Co.**, 37 West 20th St., New York, N. Y.

MODERN DEFENSE

for Portable Cables



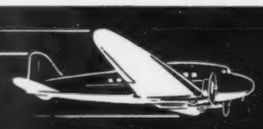
The chief enemy of portable cable performance is abrasion. It destroys the protective coverings of cables and is the cause of many cable failures. No really adequate defense was obtainable against the abrasion incident to the use and abuse that portable cables almost always get until Simplex developed "selenium rubber armor" — a tough, abrasion resistant rubber sheath that is unexcelled for wearing qualities.

We will be glad to tell you how this selenium rubber armor forms a modern defense for cords and cables if you send us a post card or letter request.

Simplex Wire & Cable Company, 79 Sidney Street, Cambridge, Mass.

Simplex – TIREX

The only cable armored with Selenium Rubber

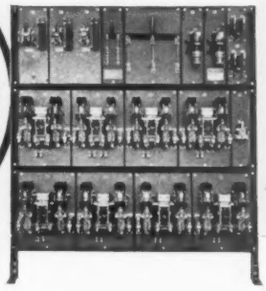


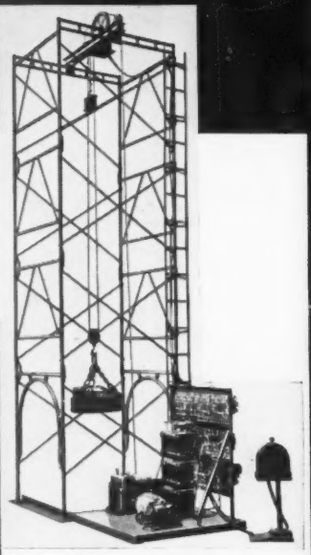
THEY *Flew* TO CLEVELAND FOR PROOF

AND THE EC&M TEST-HOIST FURNISHED IT!

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

Typical EC&M A-c Dynamic Controller





EC&M Test-Hoist at Cleveland, Ohio

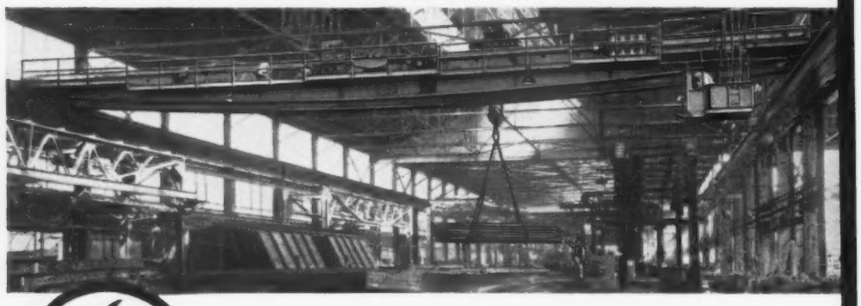
WHEN buying cranes for their army-tank plant, the executives of a prominent mid-western company were faced with the problem of securing the most efficient crane controls.

Hearing of the new EC&M all A-c Magnetic Crane Control, they wanted to see it in action. So they flew to Cleveland and witnessed a demonstration on the EC&M Test-Hoist.

Here they saw the first actual improvement in control for alternating current hoists, this EC&M all A-c Magnetic Crane Control providing three important advantages: (1) Elimination of the costly-to-maintain mechanical load-brake; (2) Ability to spot loads with extreme accuracy; (3) Smooth operation without danger of overspeeding. *And they specified these controls for four cranes.*

For existing cranes or new cranes of the overhead, whirler, portal and other types, this "EC&M Frequency Relay Magnetic Control" offers a substantial improvement in crane performance. Ask for Folder 930-A. The Electric Controller & Mfg. Co., Cleveland, O.

Overhead Crane in Southern Plant equipped with the new EC&M A-c Control



Please send A-c Crane Folder 930-A

Name .....

Address .....

MOTOR CONTROLS • BRAKES • LIMIT STOPS • MAGNETS

winding runs between two turns of the other, are operated by one slider. Both windings are of two wires of identical diameter made of materials with different specific ohmic resistances such as nickel-copper and nickel-chrome alloy. Resistance materials are both insulated with Fiberglas.

•

Thermostat

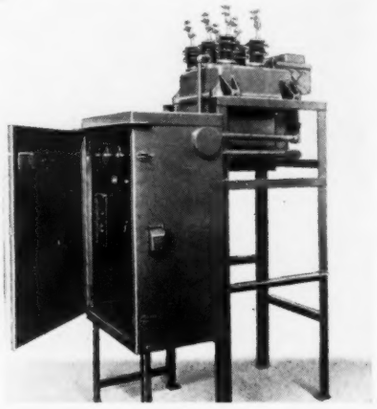
"BX Strip" type thermostat; in maximum temperature ranges of 300, 450 and 700 deg. F. **George Ulanet Co.**, Newark, N. J.

Heavy-duty thermostat comprises thermostatic element for heater loads of 1,500 watts at 115-230 volts a.c. Thermostatic element is mounted on removable cover with ¾-in. hole for BX cable connector. Unit is supplied with normally closed contacts to open with rise in temperature or normally open contacts to close with rise.

•

Reclosing Equipment

Standardized automatic reclosing equipment has been announced for use with outdoor oil circuit breakers of from 50,000 to 250,000 kva. interrupting capacity,



Automatic reclosing equipment cabinet mounted on outdoor oil circuit breaker. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, **Pa.**

400 to 600 amp. at 7.5 kv. and 600 to 1,200 amp. at 15 kv. a.c. Equipment utilizes the "RC" recloser and includes complete breaker accessories, such as current transformers, breaker trip coils, "rectox," etc., and a control cabinet and panel wired and mounted on the breaker frame. It is used in conjunction with types "FO-22-A" and "GO" oil breakers.

•

Fluorescent Starter

"Mirastat" lamp starter; interchangeable with glow-type starters; in three sizes for lamps from 15- to 100-watt. **Hygrade Sylvania Corp.**, Salem, Mass.

Fluorescent lamp starter is of the modified thermal type, having two separate contacts, one for normal starting of the lamp and the other for restarting in case the lamp is momentarily turned off. While the lamp is in operation, the bimetal strip, which comprises the moving element on the starter, is in a position midway between the two contacts. Contact which provides initial starting automatically closes when lamp is not in operation to assure prompt preheating of the electrodes and positive

IT'S EASY TO FIND

in the ROEBLING Catalog of Building Wire!

WHAT WE NEED TO KNOW —AT A GLANCE!
COVERS ALL BUILDING WIRES UP TO 600 V.
ROEBL
REWIRING JOBS SURE MEAN BUSINESS TO US!
I SEE ROEBLING MAKES ALL 4 THIN-WALL INSULATIONS
ROEB
THESE PROBLEMS AND ANSWERS CERTAINLY HELP ME!
ROEBLI
IT HAS DATA ON SERVICE ENTRANCE CABLES, TOO

Don't fail to Send for and *Use* this new Catalog No. 104

Every man in the Electrical Industry—Contractors, Electrical Engineers, Utility Men and Equipment manufacturers, alike—is keenly alive to the possibilities opened up by small diameter Building Wire. But, in today's upswing of rewiring work and new construction, Thin Wall alone cannot carry the whole load.

While many men are wondering what to do, you can turn to this Roebling Building Wire Catalog and get complete data on *all* types of 600 volt rubber-covered wires for both new and existing buildings. Handy data for selecting insulation, wire sizes and constructions... clear, concise tables of resistances, current carrying capacities, percent of conduit fill, etc. In fact, a wealth of information that will be helpful in selecting proper wires for your jobs. If you haven't received your copy, write for it today.

JOHN A. ROEBLING'S SONS COMPANY
Trenton, N. J. Branches in Principal Cities

ROEBLING 1841 1941 100TH ANNIVERSARY

"FORWARD MARCH WITH WIRE"

RUBBER COVERED POWER CABLES • BUILDING WIRE

ARMORED CABLE • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • VARNISHED CAMBRIC

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

Up Goes the Need for

CRESCENT CABLES

- RUBBER POWER CABLE
- VARNISHED CAMBRIC CABLE
- SIGNAL CABLES
- CONTROL CABLES
- BUILDING WIRE and CABLE

CRESCENT WIRE and CABLE

Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESCENT ENDURITE SUPER - AGING INSULATION

starting of the lamp. Positive restarting is provided through the action of the thermal element in closing the other contact long enough to permit adequate preheating of the electrodes.

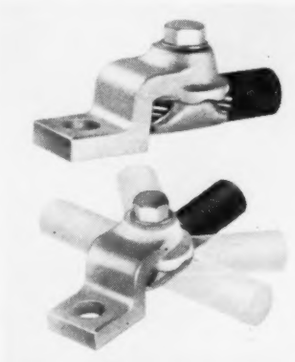
Battery Transfer Truck

Battery transfer truck, "No. 1917"; capacity 2,500 lb. **Lewis-Shepard Sales Corp.**, Watertown, Mass.

Designed to transfer heavy storage batteries for electric trucks to charging board and return, this wheeled truck combines an arc-welded steel frame, roller top, winch operated by two-speed crank and 1-in. height adjustment at one end.

Connector

Rotatable cable clamp on this new connector permits conductors to be joined at any angle. Connector body is made of copper alloy while clamping eye is made of



"Versilug," type "EA"; six sizes take conductors from No. 8 stranded cable to 1,000,000 circ.mil. **Burndy Engineering Co., Inc.**, 459 East 133d St., New York, N. Y.

bronze; "Everdur" bolts are used to obtain high clamping pressures and there are no exposed threads.

Service Equipment

"Magnette" Service Centers; for three-wire, 120/240-volt a.c. **Heinemann Electric Co.**, Trenton, N. J.

Branch circuit breakers and watt hour meters are combined in this meter service equipment. Service centers are arranged so that the protective devices and their housings may be installed and the meters attached when desired. Units were developed primarily for rural electric lines. Company's "Magnette" breakers are used —they allow the passage of inrush current but trip instantaneously on short circuits.

Transformers

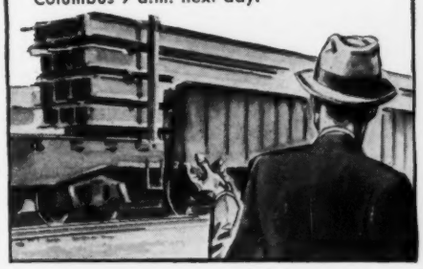
"Noflamol" transformers. **Wagner Electric Corp.**, St. Louis, Mo.

Filled with a non-inflammable synthetic liquid, these transformers are offered for installation indoors without fireproof vaults. By dividing a circuit into several sections and installing one of these transformers at each load center, long runs of secondary copper may be eliminated, thus reducing line losses and improving voltage regulation, according to the manufacturers.

JUST AN OLD SCULLY CUSTOM... *filling orders promptly!*

CHICAGO: Rush order from railroad received at 4:20 p.m. — we delivered goods at freight house 5:15 p.m. the same day.

CLEVELAND: Order for beams cut to special lengths received 5 p.m.; delivered in Columbus 9 a.m. next day.



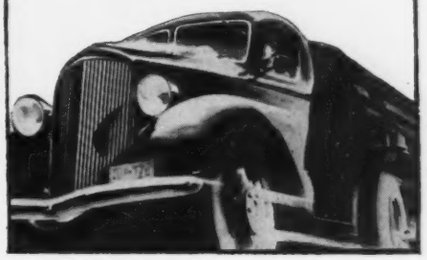
ST. LOUIS: Rush order for 12,000 lbs. miscellaneous material —some of which had to be cut—received at 2:15 p.m. Loaded on customer's truck at 4:00 p.m.

PITTSBURGH: Bridge job delayed at critical point by lack of four plates—we cut them and delivered in fifty minutes.

ST. PAUL: Emergency order received after closing. Shipment delivered in Fargo, N.D., next morning.

NEWARK: Order for 1½ tons of beams received late afternoon —shipped by fast freight; and delivered next morning.

BALTIMORE: Order received 4:30 p.m. for steel to repair breakdown — delivery made at 6:25 p.m.



BOSTON: Emergency call received on holiday afternoon. Goods delivered early next morning.

FAST, friendly service is the rule at each of the eight Scully warehouses—whether your order is large or small. That's what has made the Scully name famous. We have huge stocks on hand, ready for immediate delivery. And our warehouses are located in the great manufacturing centers—another reason why we can get your orders to you in such a hurry. So now—when quick delivery is so important whether or not you are working on defense business — give us a trial. Call Scully — for steel, steel products, copper or brass. Phone, wire or write the warehouse nearest you.

We have a complete stock of ELECTRICAL SHEETS in our Chicago warehouse

SCULLY STEEL PRODUCTS COMPANY

Distributors of Steel, Steel Products, Copper and Brass

Warehouses at CHICAGO
ST. PAUL - MINNEAPOLIS
NEWARK, N.J.

The Mark of Quality

USS Scully Service

CLEVELAND • PITTSBURGH
BOSTON • BALTIMORE
ST. LOUIS

The Mark of Service

UNITED STATES STEEL

NEWS ABOUT PEOPLE

Piske Elected Treasurer of North American Co.

Announcement has been made of the retirement of Robert Sealy as treasurer and a director of the North American Co., effective December 31, after more than 35 years of service with the company and subsidiaries.

Frederick H. Piske has been elected to succeed Mr. Sealy as treasurer. Mr. Piske is also a director and a vice-president.

Mr. Sealy, who is 61 years old, got his first job as a messenger for the Western Union Telegraph Co. in 1894 and later went with the Erie Railroad, becoming head of the accounting department of its coal companies. His first connection with the North American Co. began in 1905, first in charge of

Bachrach

F. H. Piske

accounting for West Kentucky Coal Co. and then as sales manager of the Milwaukee Electric Railway & Light Co. (now Wisconsin Electric Power Co.). He became assistant treasurer of the North American Co. in 1913, and has been treasurer continuously since 1922 and a director since 1933.

Mr. Sealy is also retiring from other offices, including those of director and officer of North American Light & Power Co., North American Utility Securities Corp. and director of Wisconsin Electric Power Co., Wisconsin Gas & Electric Co., Wisconsin Michigan Power Co., Union Electric Co. of Missouri, Mississippi River Power Co. and the St. Louis County Gas Co.

Mr. Piske has been with the North American Co. for almost thirty years. Starting as a stenographer in 1911, he became assistant secretary in 1917 and secretary in 1926. In the spring of 1937 he was elected a vice-president and a director. Mr. Piske is also a director and vice-president of the North American Light & Power Co. and of the North American Utility Securities Corp.

•

▶ A. B. HILL of Little Rock has been appointed a member of the Arkansas Utilities Commission by Gov. Homer M. Adkins.

▶ ALBERT L. PEARSON, formerly with the Lockwood, Greene & Co. engineering organization at Boston, and recently a staff engineer of the consulting house of Jackson & Moreland, Boston, has joined the Boston metropolitan district water supply commission in an electrical engineering capacity.

▶ DR. ERIC A. WALKER of the electrical engineering department of Tufts College, Mass., has been appointed associate professor of electrical engineering at the University of Connecticut, Storrs, Conn. Dr. Walker was graduated from Harvard University in 1932 and received his doctorate there in 1935. He has been on the staff at Tufts since 1934, and has been a consultant of the Doble Engineering Co., Medford Hillside, Mass., for some time. PROF. A. W. LUCE of Lehigh University has been appointed head of the mechanical engineering department at the Connecticut institution, succeeding Prof. Walter L. Eidel, who recently resigned.

H. L. Erlicher Assigned New Executive Duties

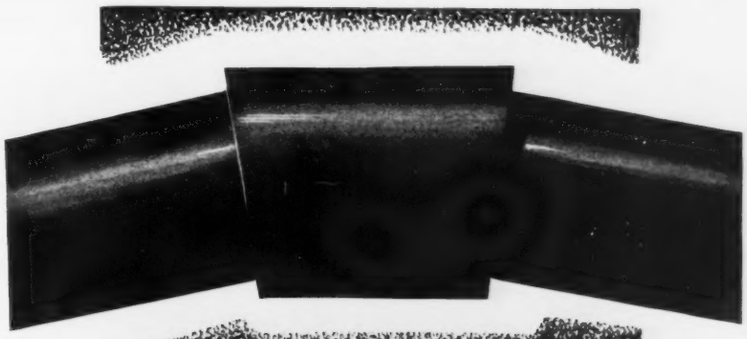
Harry L. Erlicher, purchasing agent of the General Electric Co. since 1931 and an employee of the company for forty years, was elected a vice-presi-

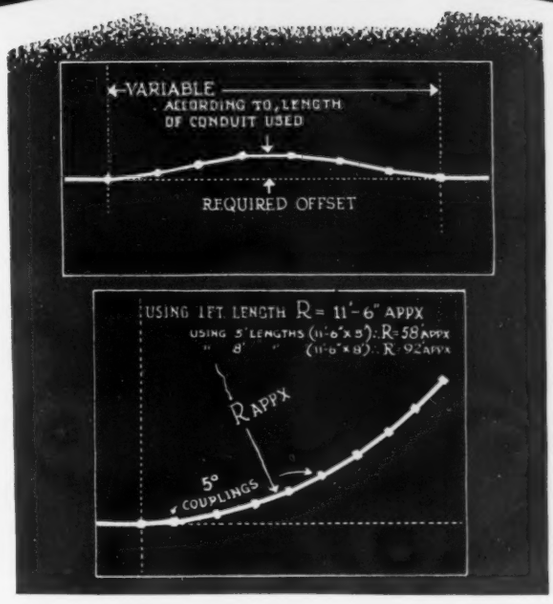
dent at a recent meeting of the board of directors in New York. He will continue to be in charge of the company's purchasing activities.

Mr. Erlicher's first job with General Electric was as a messenger boy. He was 14 years of age at that time. Purchasing interested him and when he was advanced to office boy he asked if he might be assigned to the purchasing department. Advancing in the ranks, he was named a buyer in 1910, was promoted to assistant purchasing agent in 1923 and in 1931 was named general purchasing agent, when L. G. Banker retired.

•

▶ FRANCK R. HAVENNER, former Congressman and one time San Francisco supervisor, has been appointed to a six-year term on the California State Railroad Commission by Gov. C. L. Olson. As a San Francisco official Mr.




VARIABLE
ACCORDING TO LENGTH OF CONDUIT USED
REQUIRED OFFSET
USING 1 FT. LENGTH R = 11'-6" APPX
USING 5' LENGTHS (11'-6"x 5"): R=58 APPX
" 8' " (11'-6"x 8"): R=92 APPX
RAPPX
5° COUPLINGS

The New ORANGEBURG 5° Angle Coupling

★

HOW TO REDUCE COSTS of Running Conduit Around Obstacles or Curves

No more "springing" joints to get around something; no more straining couplings; no more possibilities of leaky joints!

This new Orangeburg 5° Angle Coupling with its accurately machined taper, when tapped home firmly provides a tight joint—as tight as if made by the standard coupling.

By this one item you can meet almost any type of condition. No need for special bends or a variety of special items on any ordinary job.

On your next order for Orangeburg includes a number of these angle couplings. Your crews will be glad to have them available. They'll save time and trouble going around unexpected obstacles or curves.

★

Orangeburg Fibre Conduit is manufactured today under the most precise of instrument controls and many inspections. Now, after 48 years on the market, its quality is higher than ever. With it you can get complete cable protection — protection against outside influences as well as internal electrolysis and corrosion.

Sales Agent — Distributors

General Electric Supply Corp.

Graybar Electric Co., Inc.

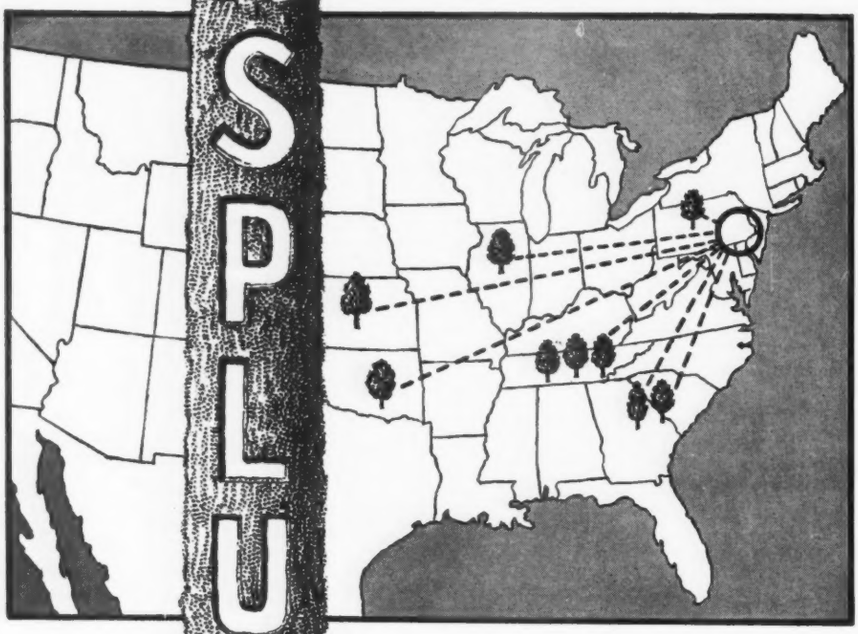
MADE AT ORANGEBURG, NEW YORK BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVE., NEW YORK CITY

ORANGEBURG NOCRETE for installation without concrete encasement
STANDARD for installation with concrete encasement

NORTH to SOUTH · EAST to WEST

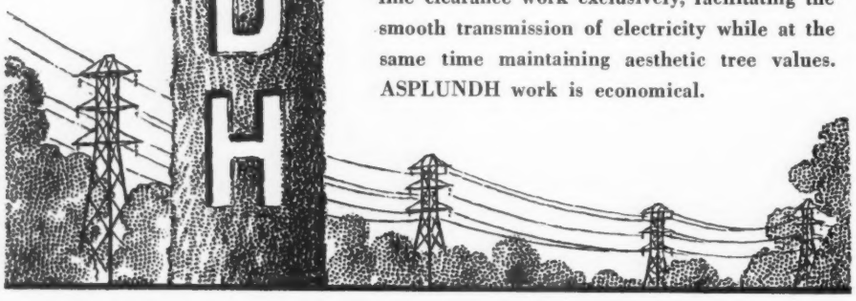
There's A National Demand for Beautiful Trees

ASPLUNDH



. . . . . And a national demand for uninterrupted electric service.

ASPLUNDH recognizes these two demands and assists utility companies in preserving the public good will by careful attention to their line clearance problems for ASPLUNDH does line clearance work exclusively, facilitating the smooth transmission of electricity while at the same time maintaining aesthetic tree values. ASPLUNDH work is economical.



TREE EXPERT COMPANY

JENKINTOWN *OGONTZ 3750* PENNSYLVANIA

—BRANCH OFFICES—

CHICAGO, ILLINOIS *Randolph 7773*	WASHINGTON, D. C. *Shepherd 6115*	PITTSBURGH, PA. *Atlantic 9798*
BINGHAMTON, N. Y. *Binghamton 4-5314*	BALTIMORE, MD. *Plaza 7656*	NEW CASTLE, PA. *New Castle 2285*
COLUMBUS, OHIO *Adams 5432*	ALEXANDRIA, VA. *Alexandria 3581*	RUTHERFORD, N. J. *Rutherford 2-7434*

LINE CLEARANCE EXCLUSIVELY

Havenner was a staunch advocate of municipal distribution of Hetch Hetchy power and in Congress was a member of the so-called "public power bloc."

▶ M. J. DEVANEY has been appointed assistant general superintendent of the South Chicago works of the Carnegie-Illinois Steel Corp., succeeding H. A. Strain, whose promotion to the position of director of raw materials, fuel and power was recently announced. At the Gary works E. G. HILL has been promoted to the assistant general superintendent's post, succeeding S. M. Jenks, who recently was advanced to the general superintendency, to succeed E. E. Moore, recently made vice-president in charge of industrial relations.

▶ A. W. GARDES has been appointed factory manager of the Eureka Vacuum Cleaner Co., Detroit, Mich., in charge of production. Mr. Gardes was formerly connected with the National Cash Register Co., where he was employed for sixteen years.

▶ GEORGE A. WENDT has been appointed acting manager of the Canadian Westinghouse Co.'s Montreal office. A native of Higginsville, N. Y., and a graduate of Syracuse University, Mr. Wendt has been in the service of the Canadian Westinghouse Co. since 1905. In 1922 he inaugurated the now famous series of broadcasts to the Arctic. These were followed by broadcasts to the Antarctic expeditions of Commander Byrd and Sir Hubert Wilkins and to the expedition of the Orinoco River.

▶ ROY W. OLMSTEAD, district superintendent of the Illinois Northern Utilities Co., Prophetstown, Ill., retired from active service December 1, after 40 years in the utility business. Mr. Olmstead began his career in the industry when on January 1, 1900, he and a friend bought the Prophetstown Electric Light Co. (McNeill Electric Company), founded in 1896. Mr. Olmstead became sole owner of the company in 1903 and with the subsequent organization of the Illinois Northern Utilities Co. sold his interest and remained with the organization as district superintendent. He will be succeeded by CHARLES O. ROESE, who has been with the company for seventeen years.

▶ FRANK E. BODINE, prominent in electrical and engineering activities in Utah for the past twelve years, has been named manager of sales for the Salt Lake City office of the Westinghouse Electric & Manufacturing Co. LEWIS E. BROWN, sales manager for Westinghouse in that city since mid-1931, has been made special representative and will devote his time to the mining company activities in Montana,

Fiberglas* Insulation cut losses from downtime on the toughest jobs

LAST YEAR a certain Midwestern steel plant changed over to Fiberglas for electrical insulation.

Result: $24,000 saved on maintenance (according to the company's own figures).

In addition, *they had less downtime* on equipment that worked in moisture...

. . . in scorching heat, dust, flying scale-particles from the rolling mills . . . over pickling baths where corrosive acid fumes surround the motors . . . and on cranes where many stops and starts cause serious overloads.

What's more, the company made that $24,000 saving even though they had *more* equipment running *more* hours than the previous year!

Wherever you have tough jobs to do, Fiberglas may well do them better, with fewer headaches, and at less cost.

Perhaps you don't have motors working under tough conditions. Perhaps the surroundings in which your motors work are entirely normal.

Then so what?

Is it possible for Fiberglas-insulated motors to help you?

Yes! *And in a very important way!*

Today, industry is gearing up for defense production. 24-hour schedules are becoming more and more common. And as machinery operates more hours per day and at greater speeds, *the hazard of downtime mounts.*

You need an additional safety factor in your motors. And you can get the maximum safety factor in standard-size Fiberglas-insulated motors.

Also, today important motor manufacturers are making smaller-size Fiberglas-insulated motors which operate safely at approved higher temperatures.

And the pay-off?

Even these smaller motors have a substantially larger safety factor than ordinary motors insulated with class A materials. And their cost is little, if any, more.

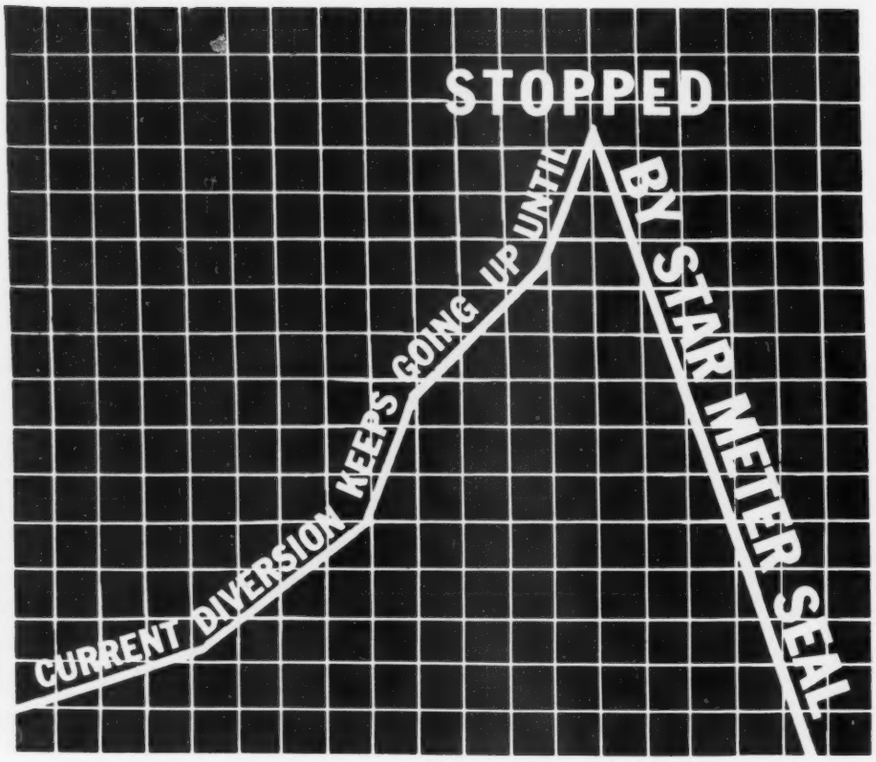
So, with the expensive bugaboo of downtime looming larger on the industrial horizon, watch out! In new equipment or in your next repair job, specify complete Fiberglas Electrical Insulation. *Owens-Corning Fiberglas Corporation, Toledo, O. In Canada: Fiberglas Canada, Ltd., Oshawa, Ont.*

OWENS-CORNING

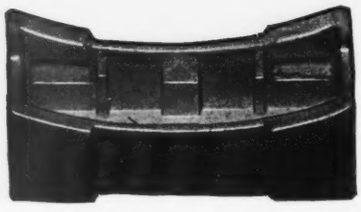
FIBERGLAS*

*T. M. Reg. U. S. Pat. Off.

TO ELECTRICAL ENGINEERS: Besides being a superior insulation for motors and generators, as the above case history shows, we believe you will find Fiberglas has definite advantages for all types of electrical equipment. This insulation comes in all standard forms. Write us for further technical data.



YOU CAN SAVE THOUSANDS OF DOLLARS ANNUALLY



EQUIP ALL CS METERS WITH

STAR METER SEALS

It's just as simple as it sounds to prevent those enormous losses, suffered through meter tampering, permanently, effectively and economically. This inexpensive, patented porcelain cap which fits all CS type meters is a sure trap for the power thief. It must be destroyed or mutilated beyond all further use before it can be removed. Join with the many other utilities who have stopped current diversion by this method—and are increasing income without building up the load.

Send for Sample— Address Meter Seal Dept.

★ THERMOLAIN
Rugged, Refractory Porcelain for Radiants, Ranges and Heaters

The STAR PORCELAIN COMPANY

★ LAVOLAIN INSULATING BEADS
13 Sizes

51 MUIRHEAD AVE., TRENTON, N. J.

MAKERS OF ELECTRICAL PORCELAIN SINCE 1899

Utah and Arizona. Following graduation from the Colorado State Agricultural College at Fort Collins, Colo., Mr. Bodine joined Westinghouse at East Pittsburgh, Pa. In 1928 he was made a member of the sales force and was assigned to the Salt Lake City office. For the past twelve years he has been active in the sale of Westinghouse electrical apparatus and equipment to central stations in the Salt Lake area.

▶ W. H. FELDMANN, vice-president in charge of sales since 1937, has recently been elected general manager of Electric Machinery Manufacturing Co., Minneapolis, Minn. Mr. Feldmann has been associated with Electric Machinery Manufacturing Co. for eighteen years, having been in charge of district sales at Cleveland and Chicago before his appointment as general sales manager in 1927. He was elected a director in 1936.

▶ T. D. SCARFF has been appointed assistant manager of the Midland Division of the Lamp Department of General Electric Co. Formerly assistant to the manager, Mr. Scarff is succeeding W. M. States, retired.

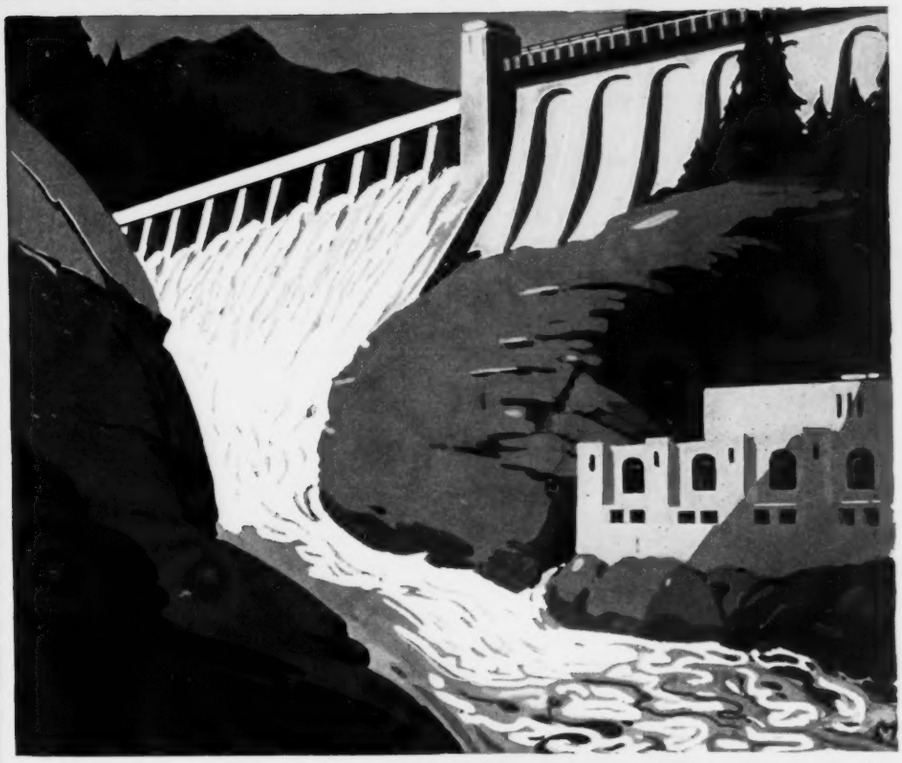
OBITUARY

▶ GEORGE M. BROOKS, general counsel, executive vice-president and a director of the Okonite Co., New York, died January 1 in the Columbia Presbyterian Medical Center in New York, after an illness of several weeks. Born in Dalton, N. H., Mr. Brooks was graduated from the Yale Law School in 1879. He had been with the Okonite Co. since 1882 and had been a vice-president for more than twenty years. He was a vice-president and a director of the Okonite Callender Cable Co., Inc., an affiliate of the Okonite Co. Mr. Brooks was 83 years of age.

▶ PROF. JACQUES ARSENE D'ARSONVAL, one of France's most noted scientists, died at his estate of Laborei, near Limoges, on December 31. He was 89 years old. Half a century ago Professor d'Arsonval predicted that diseases would be treated by electricity, heat and light. Long since, electrotherapy has been generally accepted. Professor d'Arsonval developed a series of therapeutic apparatus which have not been modified in principle in more than forty years, but have been used more and more in the treatment of disease. His researches led to his discovery of high-frequency currents and diathermy.

▶ H. GODFREY PHILLIPS, formerly vice-president and treasurer of the Owens-Illinois Glass Co. and other glass companies, died December 31 in Johns Hopkins Hospital, Baltimore, at the age of 61. Mr. Phillips resigned as treasurer of the Owens-Illinois Glass

POWER



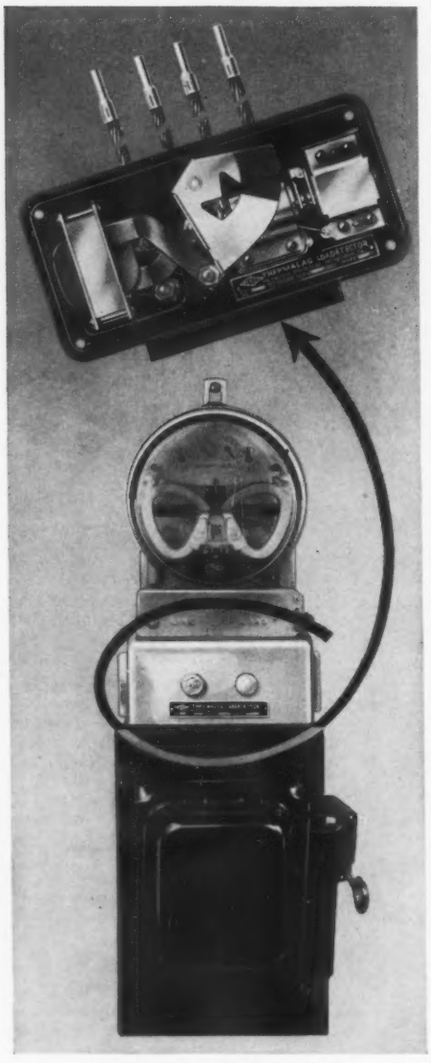
BY S-MORGAN SMITH Co.

has been synonymous with the generation of ELECTRIC POWER from Water, since we installed our first turbine driving an electric generator in 1895.

Write for Bulletins - S. Morgan Smith Co. York, Pa.

MORE THAN 63 YEARS OF HYDRAULIC EXPERIENCE

Introducing •



. . . A NEW LOAD SURVEY INSTRUMENT

The TESCO THERMALAG LOADETECTOR. Functions on ampere demand. It is a thermally operated load indicator, compensated for ambient temperature. Easily installed on existing meter installations, it provides a continuous connected load survey. A red flag indicates an ampere demand for a definite time period exceeding that for which the device was originally calibrated.

Write today for technical data

THE EASTERN SPECIALTY COMPANY

3617-19 North 8th Street Phila., Pa.

Co., Owens-Illinois Can Co. and Libbey Glass Co. a year ago because of ill health. He remained as director of the board of the Owens-Illinois Glass Co.

▶ CHARLES BILLIAR, chief engineer and substation operator for 50 years at the Wooster, Ohio, plant of the Central Ohio Light & Power Co., died December 22, in his eighty-second year. Mr. Billiar had retired from active business life.

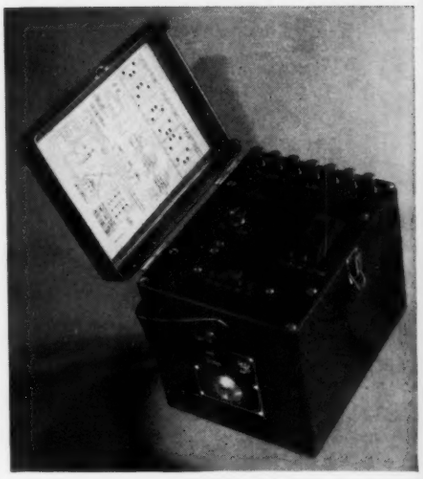
▶ ELLIS L. DENNIS, 60, formerly executive secretary of the Massachusetts board of examiners of electricians, died at his home in Wollaston, Mass., on December 29. He was retired in 1939 after occupying that position fifteen years.

▶ GEORGE R. GRANT, general attorney for the New England Telephone & Telegraph Co., Boston, former chairman of the public utility section of the American Bar Association and one of the most distinguished lawyers in the northeastern public utility field, died at Wellesley, Mass., on December 28.

▶ FRED R. DAVIS, a founder of the Audit Bureau of Circulations and advertising space buyer for the General Electric Co. at Schenectady for 35 years, died December 26 at his home in that city after an illness of two years. He was 64 years old. Mr. Davis helped found the Audit Bureau of Circulations in 1914. He served as a director from that date until his death and since 1927 had also been first vice-president of the organization. In 1901 he entered the General Electric organization as a test student and in 1902 went to Fort Wayne, Ind., as publicity manager of the Fort Wayne Electric Co. In 1905 he joined the General Electric advertising department in Schenectady.

▶ JOHN G. CALLAN, 65, professor of industrial management at the Harvard Graduate School of Business Administration, and a widely recognized authority on steam turbines, died at Cambridge, Mass., on December 31, from a heart attack. He was born in Northfield, Conn., and was graduated from the Massachusetts Institute of Technology in electrical engineering in 1896. In his early career he was connected with the Boston Edison and General Electric companies and for six years was associated with Arthur D. Little, Inc., chemical engineers, Boston. From 1915 to 1920 he was professor of steam and gas engineering at the University of Wisconsin, going to Harvard from there. He held more than 70 patents on steam turbines and other prime movers. During the World War he directed a three-man commission in England and Scotland studying applications of marine Diesel engines. He was highly regarded as a consultant.

INVESTIGATE THE



TESCO LOAD ANALYZER FOR LOAD SURVEYS

An auxiliary instrument which enables a single graphic wattmeter to record (1) Kilowatt Demand (2) Reactive KVA Demand (3) Power Factor of an industrial or commercial load.

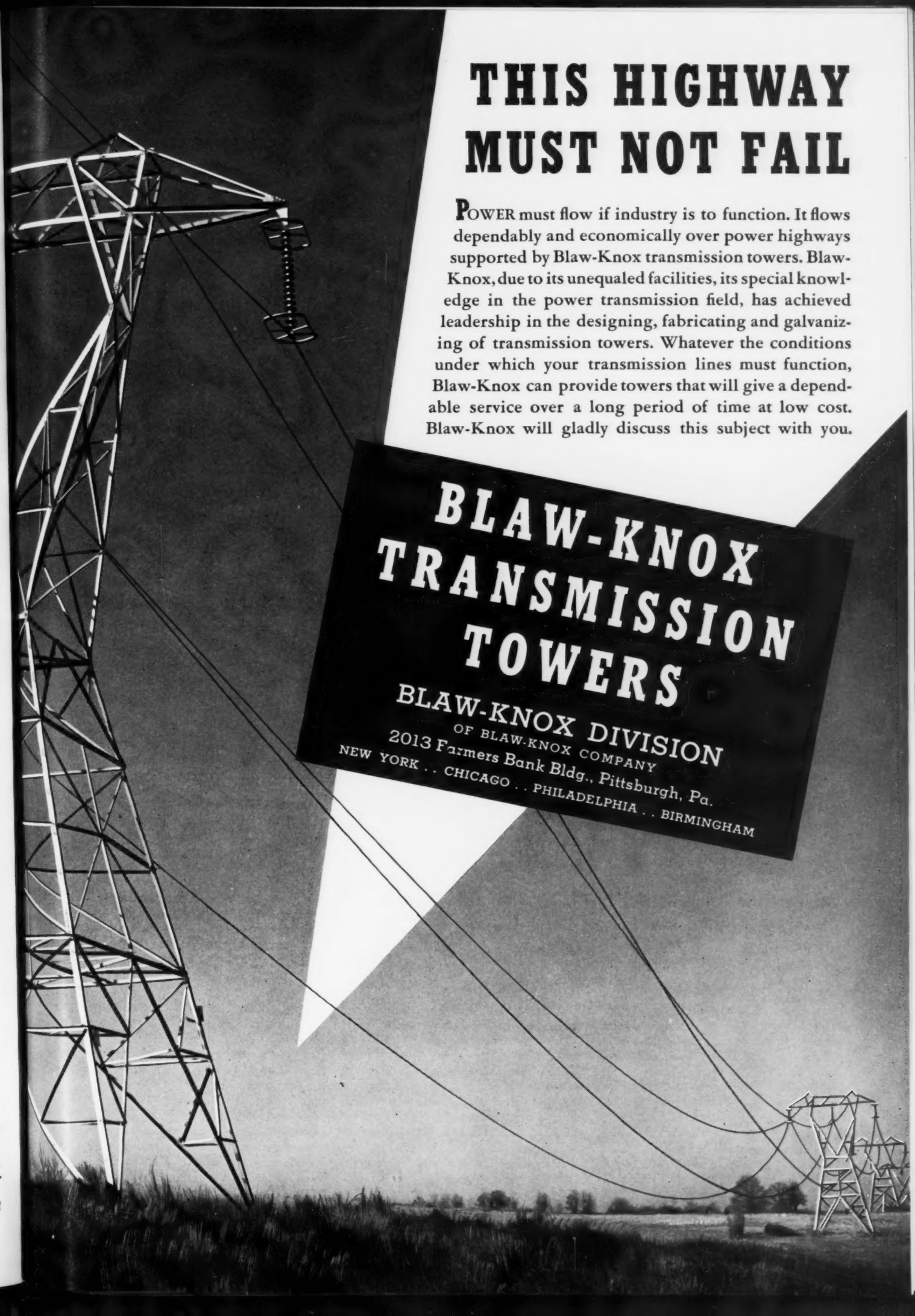
The load analyzer is, in effect, *a combination of time switch and phasing transformers.* The potential elements of the graphic wattmeter are periodically switched from direct line potential (for recording KW) to quadrature potential (for recording RKVA) and back again.

The momentary interruption of potential at the end of each time interval gives a definite mark on the chart for indentifying the KW and RKVA records, which are made by the same pen. Identification is positive, even when KW and RKVA are of the same magnitude, because the respective "on" periods of each are unequal.

Power factor may easily be calculated from the respective values of KW and RKVA demand.

THE EASTERN SPECIALTY COMPANY

3617-19 North 8th Street Phila., Pa.



THIS HIGHWAY MUST NOT FAIL

POWER must flow if industry is to function. It flows dependably and economically over power highways supported by Blaw-Knox transmission towers. Blaw-Knox, due to its unequaled facilities, its special knowledge in the power transmission field, has achieved leadership in the designing, fabricating and galvanizing of transmission towers. Whatever the conditions under which your transmission lines must function, Blaw-Knox can provide towers that will give a dependable service over a long period of time at low cost. Blaw-Knox will gladly discuss this subject with you.

BLAW-KNOX TRANSMISSION TOWERS

BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
2013 Farmers Bank Bldg., Pittsburgh, Pa.
NEW YORK . . CHICAGO . . PHILADELPHIA . . BIRMINGHAM

MANUFACTURING - MARKETS

Refrigerator-Range Sales Advance

Sales of electric refrigerators and ranges in November continued to show sharp increases over 1939, according to reports issued recently by the National Electrical Manufacturers Association.

A total of 74,233 refrigerators was sold domestically in November by thirteen companies, compared with 51,258 sold in November 1939. For the eleven-month period the volume amounted to 2,421,390 units, compared with 1,733,630 for the similar period of the preceding year.

World sales in November amounted to 83,548 units, compared with 60,179 units in November, 1939, and for the eleven-month period world sales reached a total of 2,560,687 units, compared with 1,887,240 units for the similar period of 1939.

Electric range sales in November amounted to 25,248 units, compared with 19,008 units in November, 1939, and for the eleven-month period sales totaled 379,613 units, against 283,417 units for the similar period of 1939.

•

Opens New Branch Office; Makes Dealer Additions

A new branch office to handle distribution of its products in western Pennsylvania and a part of West Virginia has been established in Pittsburgh by Frigidaire Division, General Motors Sales Corp. The newly established branch takes over the territory formerly operated by the Electric Products Corp. As manager of its branch office, which will maintain temporary administrative quarters at 404 North Craig Street, Frigidaire has appointed P. K. Abry, who has been associated with the company in various sales capacities.

Two additions have been made to the dealer development staff of Frigidaire. A. R. Thomas, one of the new members, will cover New England and the eastern area and R. S. Bradford, who has been with Frigidaire for a number of years as a district representative and most recently as sales manager in the Columbus, Ohio, area for the company's Dayton district, will cover the central area of the United States.

•

Manufacturers Make Sales Appointments

Steel and Tubes Division, Republic Steel Corp., has announced the appointment of C. D. Belt & Co., Denver, Colo., as sales agent for the electrical division covering the states of Colorado, Wyoming and Montana. This organization will handle Steel and Tubes electrical metallic tubing, which has been marketed under the trade name of Electrunite Steeltubes. C. D. Belt & Co. will also handle Fretz-Moon rigid conduit, both galvite and enamelite.

Despatch Oven Co. has appointed Gerald B. Duff, 68 Clinton Avenue, Newark, N. J., as exclusive sales engineer for Despatch furnaces and core ovens in the Newark-New York territory.

W. A. Hesse & Co. has appointed F. L. Hockensmith, 443 South San Pedro Street, Los Angeles, Calif., as representative for southern California and Arizona.

•

Navy Awards Contracts

Announcement has been made that the Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded a contract to Westinghouse Electric & Manufacturing Co. for a turbo-alternator and accessories, at $177,300, for installation at Norfolk Navy Yard, Portsmouth, Va.; also, an award to C. H. Wheeler Manufacturing Co., Philadelphia, Pa., at $23,750, for a condenser and auxiliary equipment for same yard (Specifications 10127).

York Net $483,122; Sales Rise 7.5%

The report of the York Ice Machinery Corp. for the fiscal year ended September 30 shows a gain of 7.5 per cent in sales, an increase of 20.6 per cent in unfilled orders on hand and net earnings of $483,122 after taxes, contrasted with a loss of $185,077 the year before.

With sales of $16,163,895, only $1,133,617 greater than in the preceding year, net earnings before income taxes showed an improvement of $782,682. Working capital increased by $566,792 and the company closed its year with a larger cash balance on hand than at any year-end during the past decade.

Progress in sales planning and in development of new products contributed during the past year to a much steadier flow of orders. York's part in the National Defense Program is shown by such recent business as refrigeration and air-conditioning products for modern windowless industrial plants, smokeless powder plants, machine tool and other precision instrument factories, a variety of plants manufacturing synthetic products, etc.

The management is working on plans to be submitted to stockholders in a few weeks, contemplating a change in corporate name as well as a proposal relating to capital structure.

Orders on hand at the end of the fiscal year amounted to $3,046,697.

•

Air Conditioning Society Forms Room Cooler Group

A room cooler division has been formed by the Air Conditioning and Refrigerating Machinery Association, Inc., reports S. E. Lauer, association president. Membership in the room cooler division will be limited to those association members engaged in the manufacture or sale of self-contained room coolers and room air conditioners

WANTED
. . . New FULTONS,
EDISONS and CHRYSLERS
The great strength of the United States is not its billions of gold, its tons of metal or its giant industrial capacity. It is the native mechanical skill and inventive power of its people.
In a crisis, this democracy always gives us the men and the ideas the nation needs.
Usually, we imagine that these ideas come from the scientific laboratories or from the drawing boards of engineers. Many do. But just as many and just as great ideas come from the men at the machines of industry.
For scientists, there is the Nobel Prize. For engineers, a score of awards. But there is no award for the gifted men now working at the lathes, forges and work benches of industry.
As a contribution to our national security, Revere Copper and Brass Incorporated is establishing an award of $10,000.00 for the workmen in America's metal working industries.
Donald Dallas
PRESIDENT
REVERE COPPER AND BRASS INCORPORATED

The REVERE AWARD

of $10,000 for Wage Earners in America's Metal Working Industries

THE Revere Award is made by Revere Copper and Brass Incorporated to help speed national defense by encouraging the mechanical genius and inventive talent of American wage earners.

The Revere Award totals $10,000.00 divided as follows:

1st Award	$5,000.00
2nd Award	2,500.00
3rd Award	1,000.00
4th to 9th Awards	250.00 each

The Revere Award is open to all wage earners (foremen and workingmen) in the metal and metal-working industries and to all machine maintenance men.

Each entry remains the property of the sender.

Selection will be made by an impartial Jury of Award consisting of men high in science, labor, the Army, the Navy and industry. The decision of the Jury of Award will be final.

Winners will be chosen for the inventions, devices, improvements or ideas which, in the Jury's opinion, contribute most to speeding up America's Defense Program.

It is desired that all entries be placed at the command of the Defense Advisory Council at Washington, D. C., subject to the entrant's own written consent.

Two or more men may cooperate in any entry.

Entries close on midnight, April 30th, 1941.

For booklet giving complete details of The Revere Award and for Entry Blanks simply write to THE REVERE AWARD COMMITTEE, P. O. Box 1805, Washington, D. C.

★ ★ ★ ★ ★

OFTEN IMITATED
. . . NEVER EQUALLED

"Since 1857"

JAWS that grip like a vise—knives that shear through the toughest wire—handles with just the right spring for comfort—that's Klein pliers!

Ask any man who knows good tools—he'll tell you, "Klein's for satisfaction"—every time!

Your copy of the Klein Pocket Tool Guide will be sent on request.

DISTRIBUTED THROUGH JOBBERS

Foreign Distributor:
International Standard Electric Corp., New York

Mathias **KLEIN** & Sons

3200 Belmont Avenue, Chicago, Illinois

in capacities up to 15,000 B.t.u. per hour.

The association states that the principal activities of the association room cooler division will be the compilation of industry statistics of sales and inventories, equipment standardization, and standard rating and testing and certification of capacities of various models of room coolers.

•

Hands Across Border

H. W. Young, president of Delta-Star Electric Co., Chicago, and L. E. Messinger, president of Canadian Line Materials, Ltd., Scarboro Junction, Canada, announce the association of their respective companies for the exclusive manufacture of Delta-Star equipment in Canada. Products will be manufactured under Delta-Star's designs with complete knowledge of Delta Star's shop practices.

•

Opens N. Y. Sales Office

Announcement has been made that the Seyler Manufacturing Co., Pittsburgh, Pa., has opened an Eastern sales office at 150 Broadway, New York, N. Y. George A. Hoeveler and Horace T. Drake have been appointed to represent the company in this district.

•

Circuit Breaker Contract

Los Angeles Water and Power Commission, Los Angeles, Calif., has awarded a contract to Kelman Electric & Manufacturing Co., Los Angeles, at $186,662 for quantity of oil circuit breakers (Specifications 3548). Also, an award at $11,412 for improvements and betterments in oil circuit breakers now in use (Specifications 3561).

•

Fairbanks, Morse Exempt

SEC has issued an order granting Fairbanks, Morse & Co. exemption from provisions of the Public Utility Holding Company Act. Inland Utilities Co., a subsidiary company of Fairbanks, Morse & Co., was also exempted as a subsidiary company.

New York Metal Prices

	Jan. 7, '41 Cents per Pound	Dec. 30, '40 Cents per Pound
Copper, electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.50	5.50
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spot	7.64	7.64
Tin, Straits	50.10	50.10
Aluminum, 99 Per Cent.	17.00	17.00

* Delivery Connecticut Valley.

The MOST COMPLETE LINE OF
Grounding Connectors

These pictures can only give you an idea of the variety, because — **Penn-Union makes ALL good types.** A complete line of clamps, studs and connectors for all applications. For all combinations of pipe, rod, flat bar, cable, braid, tubing.

Every one a **DEPENDABLE** unit of protection for personnel and equipment — of ample capacity, high mechanical strength, and resistant to corrosion.

Write us in regard to any type of grounding connector.

Also the most complete line of Service Connectors, Cable Taps, Terminal Lugs, Tees, and other fittings. *Penn-Union is the choice of leading utilities and industrials, contractors, and manufacturers of electrical equipment.*

Sold by Leading Jobbers

Write for Catalog

PENN-UNION ELECTRIC CORPORATION
ERIE, PA.

PENN-UNION
Conductor Fittings

Is that so!

FACTS ABOUT INSULATORS SELDOM DISCUSSED IN ADS, *NOT EVEN OUR OWN!*

● Without pulling any punches, here is a frank discussion of insulator problems—*questions and answers seldom seen in print*—FREE for the asking! Corning publishes this new booklet "Plain Facts about Insulators", feeling that many facts about insulators have too long remained "untouchables"—that an informal locker room discussion is definitely in order!

"Plain Facts about Insulators" tells you the authoritative inside story about the performance of modern insulators. For instance, what happens when suspension insulators are tapped square on the pin? What happens when you shoot a suspension insulator with a .22 rifle? Why is alloy used in some designs—cement in others?

If your chief problem is insulators; if you want the truth, good and bad, about the insulators you buy and use; clip and mail the handy coupon today for your FREE copy of "Plain Facts about Insulators".

SEND FOR THIS FREE BOOKLET

MAIL COUPON TODAY!

Corning Glass Works
Insulation Division
Corning, N. Y.

Please send me my FREE copy of "Plain Facts about Insulators".

Name.....

Firm.....

Address.....

City and State.....

CORNING *means* Research in Glass

Pyrex Insulators
BRAND

The SHOVEL that is
Solid Steel
in the Solar Plexus
The one spot where fighters can't take it is the solar plexus—the one spot where a shovel or spoon must take it is the shank and where the blade joins it. The blade, shank and socket of Sturd-E Solid Shank Shovels are forged in one piece from a solid bar of steel—no welds, seams or pieced together joints. This is the strongest construction known to shovel makers. To add yet more utility, the heavy 13-gauge blade is heat treated. For longer service life and greater value, specify Sturd-E Shovels made by The American Fork & Hoe Company, Cleveland, Ohio.
STURD E TOOLS
a TRUE TEMPER PRODUCT
One-piece Solid Shank, Socket Pattern Sturd-E Telegraph Shovel 22 inch handle socket, heat treated 13 gauge blade. XX grade hickory or ash handles sanded and waxed, in lengths from 6 to 12 ft.
Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

Field Reports on Business

Electrical manufacturers forecast boom business during 1941. Backlogs are now swelled with a greater volume of orders yet to come. Speeding of national defense will put an even greater strain on production facilities. Orders from utilities continue in good volume.

NEW YORK

Electrical manufacturers will enjoy boom business this year and will be hard pressed to meet production schedules. Defense demands are now heavy and will become more so as the national program is speeded. Demands from industry for electrical machinery and equipment are increasing and appear likely to grow. With electric utilities spending more this year than in any year since 1930 added demands will be placed on electrical manufacturers.

Appliance manufacturers look forward to a banner year, with sales likely to register new all-time highs. Problem may be in meeting consumer demands. The new models have caught distributor fancy and have taken well at previews. Reports indicate that manufacturers and distributors are in much sounder position for the 1941 selling position with stocks not too heavy. The backlog of orders continues to rise.

In this area retail sales soared during the holiday season and have maintained a good rate since.

Long Island Lighting Co., has contracted for a two-story office building and salesroom in Hempstead. The New York City Housing Authority has awarded contracts for a $2,000,000 public housing project in the Bronx to start soon and be completed by next September.

Engineering construction awards totaled $398,704,000 in December, the second highest ever reported.

NEW ENGLAND

There are no signs over the horizon that any slackening in business activity is in store for New England during the coming year. Rather, that long-established industries, widely diversified as to the nature of their products, will continue to demand large volumes of electrical equipment for the fulfillment of their commitments. Additions to generating plants and the extension of distribution systems of considerable extent lie ahead, among which were recently announced plans for the immediate construction of a 110-kv. transmission line from Windsor to Wiscasset, Me., a distance of about 20 miles, and also a 33-kv. line from Wiscasset to Bath, Me., both lines to be ready for service about July 1.

While many awards involving heavy electrical equipment for marine service have been rushed through during the last few months, there still remain prospects for a large volume of orders for small motors, control apparatus and wiring for light and power, in view of the large amount of plant expansion proposed for the coming year.

National Defense Commission has approved the construction of a new airplane supercharger plant for General Electric Co., Everett, Mass., at a cost of $5,837,000. A large amount of ventilating and forced-draft equipment has been purchased from the B. F. Sturtevant Co., Boston, for use by the Navy.

Floodlighting units are in demand and new installations include one group for the protection of a Bristol, Conn., plant and another, consisting of ten 500-watt lights, for a Boston shipyard.

CHICAGO

With nearly all lines of business in this area operating at exceptionally high levels, the outlook for the electrical industry is extremely favorable for the new year. The demand for a wide variety of electrical equipment continues to expand and manufacturers report sufficient volume of orders to maintain a high rate of production for a considerable period. Utilities are pushing construction programs to meet the rapidly increasing load requirements.

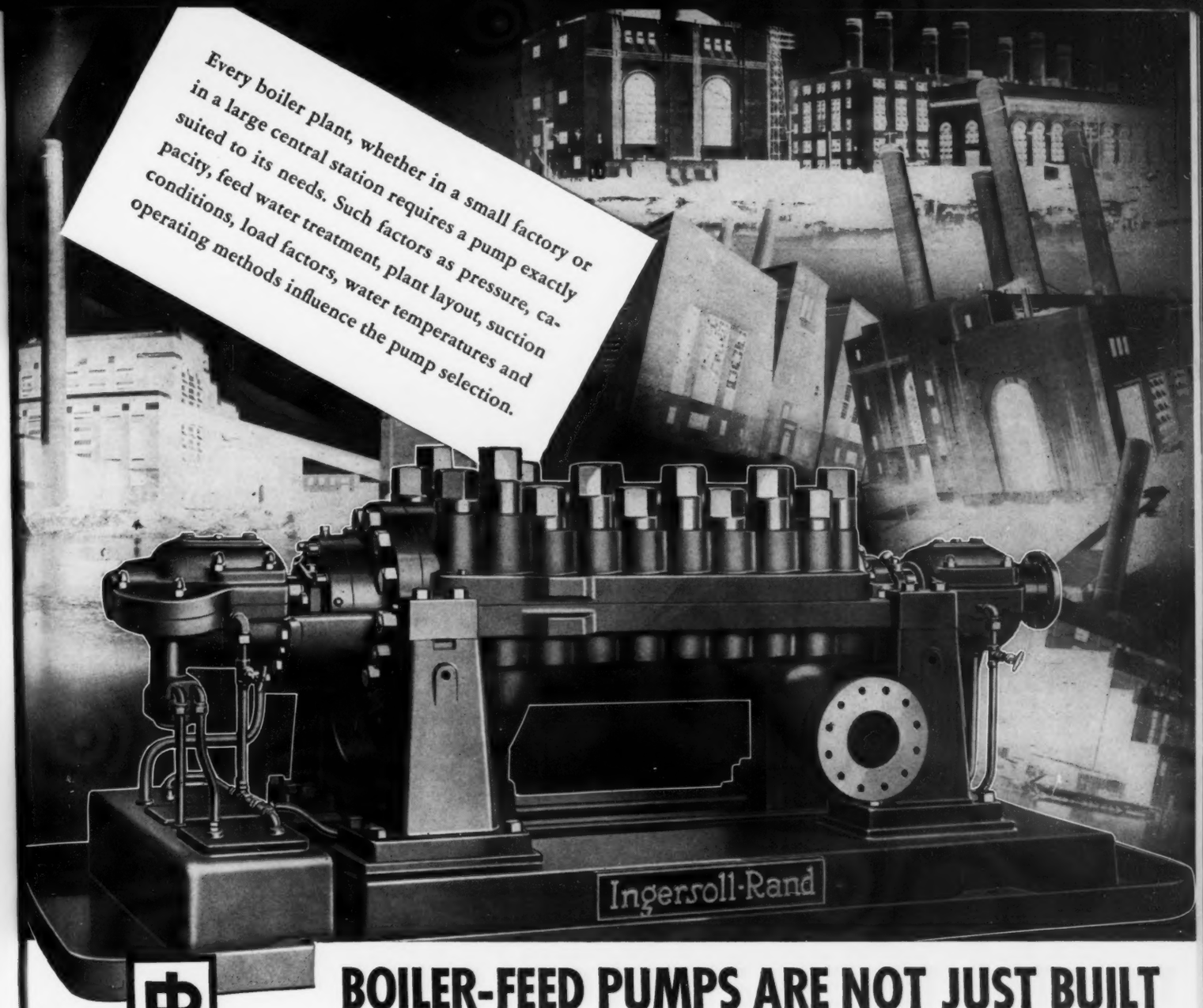
Demand for appliances and lighting equipment is steadily gaining, with excellent prospects for a record year in both lines. An order was recently placed for 3,277 fluorescent fixtures and 11,640 of the new 100-watt, 60-in. lamps. Appleton Electric Co. will build a $250,000 addition to meet increased business. Ford Motor Co. has started construction of a $160,000 addition to its Calumet City, Ill., power plant.

The defense program has been responsible for considerable business in this area, orders and sub-contracts totaling $506,517,000 having been placed during the last six months of 1940. Studebaker Corp. was awarded a contract last week for constructing and equipping new plants at Chicago, South Bend and Fort Wayne at a cost of $36,799,300. Additional orders placed here last week included electric trucks, $54,551; transformers, $50,640; electric toasters, $65,569; teletype machines, $42,054; portable drills, $248,864; Diesel generators, $97,974; electric hoists and shovels, $375,568.

PACIFIC COAST

Municipal and defense projects furnish major construction items. Moffett Field, near San Francisco, a coast counterpart of Langley Field in Virginia, reports a Westinghouse low bid of $987,711 for drive units for its windtunnel and $525,000 to be expended for civil aeronautic housing. These and similar smaller work, plus tract development, have about doubled early 1940 business in wiring and rough-in staples, with longer deliveries of wholesalers' replacements, but no disproportionate stock increases are revealed by annual inventories, just completed.

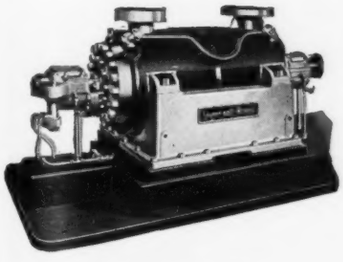
Other large machinery business include a G. E. low bid of $453,000 covering plant expansion of Bremerton Yard, near Seattle; three 10,000-kva. transformers for Bonneville; awards aggregating $74,000 for six 333-kva. transformers for Burbank, Calif.; Dravo Corp.'s low bid of $232,000 for two Diesel-electric cranes for Oakland Naval base, and four 10-ton electric bridge cranes for Mare Island. An 1,100-line automatic central office equipment is to be installed in Presidio Military Reservation, San Francisco and a 300-kw. alternator with panel and switchgear accessories in Manila radio station. Anaconda was awarded 350 miles of hollow copper cable for the Deming, N. M., area, for $124,237; while Aluminum Co. received the $695,367 award for 110 miles of 230-kv. cable for Grand Coulee line to Covington, Wash.


Every boiler plant, whether in a small factory or in a large central station requires a pump exactly suited to its needs. Such factors as pressure, capacity, feed water treatment, plant layout, suction conditions, load factors, water temperatures and operating methods influence the pump selection.
Ingersoll-Rand

Class HT boiler feed pump.

BOILER-FEED PUMPS ARE NOT JUST BUILT

They are developed



Class CHT barrel-type boiler feed pump.

Only a manufacturer with long experience in building boiler-feed pumps can select the design and materials which will assure the user of reliable service and low maintenance expense.

Ingersoll-Rand installed their first multi-stage boiler-feed pumps in 1913. The development has never stopped. Since then Ingersoll-Rand pumps have been installed in boiler plants of every size and type. The large proportion of plants selecting I-R equipment is proof of their satisfactory operation. Whenever higher pressures have been required, there has been an Ingersoll-Rand pump to meet the need.

Make I-R Cameron boiler feed pumps your choice and secure the material benefits of Ingersoll-Rand's experience in this field.

Atlanta
Birmingham
Boston
Buffalo
Butte
Chicago
Cincinnati
Cleveland
Dallas
Denver
Detroit
Duluth
El Paso
Hartford
Houston
Kansas City

Ingersoll-Rand

Cameron Pump Division
11 BROADWAY, NEW YORK, N. Y.

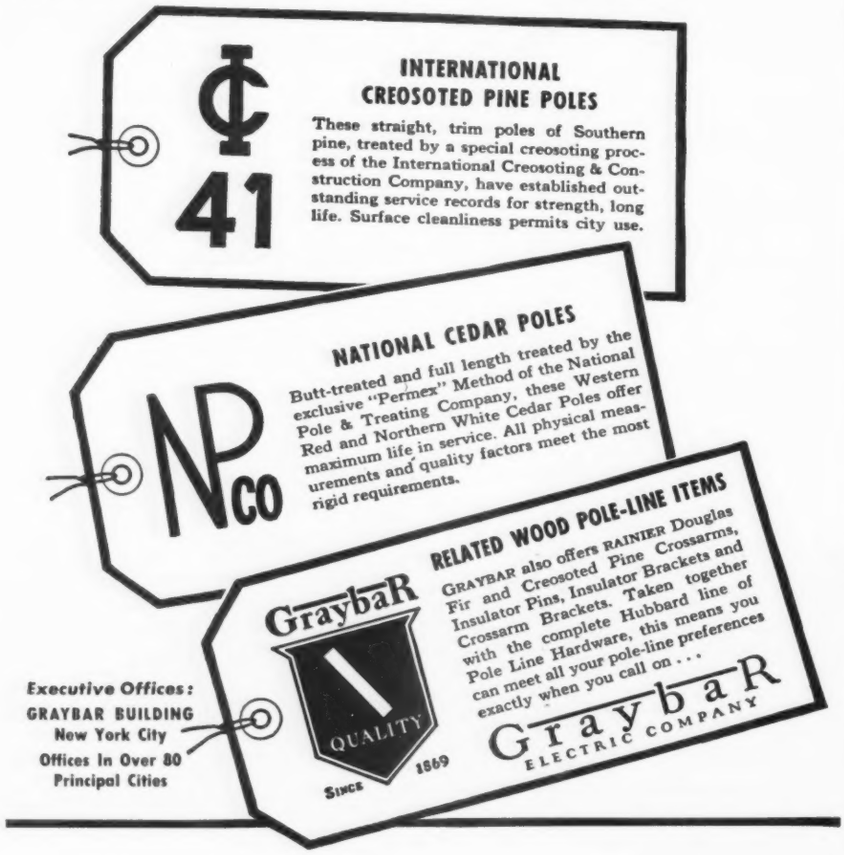
Knoxville
Los Angeles
Newark
New York
Philadelphia
Picher
Pittsburgh
Pottsville
Salt Lake City
San Francisco
Scranton
Seattle
St. Louis
Tulsa
Washington

768-10

768-10

WHEN IT COMES TO **POLES**
BOTH SIDES COME TO GraybaR

In the choice of wooden poles, GRAYBAR has recognized that differing conditions lead to different preferences. For *both* cedar and pine poles, however, leading utility and telephone companies have chosen GRAYBAR as an exclusive source of supply. When they order "via GRAYBAR", they get a double assurance of good value: (1) Top-quality lines of leading suppliers, (2) backed by the extra satisfaction insurance of the GRAYBAR tag.


IC 41
INTERNATIONAL CREOSOTED PINE POLES
These straight, trim poles of Southern pine, treated by a special creosoting process of the International Creosoting & Construction Company, have established outstanding service records for strength, long life. Surface cleanliness permits city use.
NPCO
NATIONAL CEDAR POLES
Butt-treated and full length treated by the exclusive "Permex" Method of the National Pole & Treating Company, these Western Red and Northern White Cedar Poles offer maximum life in service. All physical measurements and quality factors meet the most rigid requirements.
RELATED WOOD POLE-LINE ITEMS
GRAYBAR also offers RAINIER Douglas Fir and Creosoted Pine Crossarms, Insulator Pins, Insulator Brackets and Crossarm Brackets. Taken together with the complete Hubbard line of Pole Line Hardware, this means you can meet all your pole-line preferences exactly when you call on . . .
GraybaR
QUALITY
SINCE 1869
GraybaR ELECTRIC COMPANY
Executive Offices:
GRAYBAR BUILDING
New York City
Offices In Over 80
Principal Cities

Recent Rate Changes

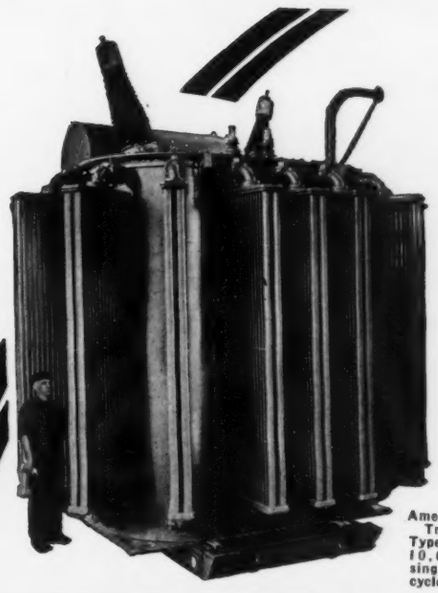
PENNSYLVANIA POWER & LIGHT CO., after a number of informal conferences with the state Public Utility Commission, has offered an annual reduction of $1,281,000, applicable to electric light and power bills. The reduction will take effect March 1. This action means a reduction to all customers on the residential and small light and power schedules. The proposal made by the company was accepted unanimously by the commission. Residential consumers affected number 329,267, plus 26,664 farms; 50,891 commercial customers; 233 small coal mining industries; 320 textile plants; 1,615 additional industrial consumers and 2,416 government establishments.

METROPOLITAN EDISON CO.'s new schedule will effect a total annual reduction in rates of $1,002,840, the Pennsylvania Public Utility Commission has announced. The reduction is distributed as follows: $376,230 to residential customers; $300,930, commercial customers; $303,880, power customers; $14,900, municipal customers, and $6,900, street lighting. The company is required to file with the commission monthly a copy of its monthly operating statements in order that the commission may determine the effect of this reduction.

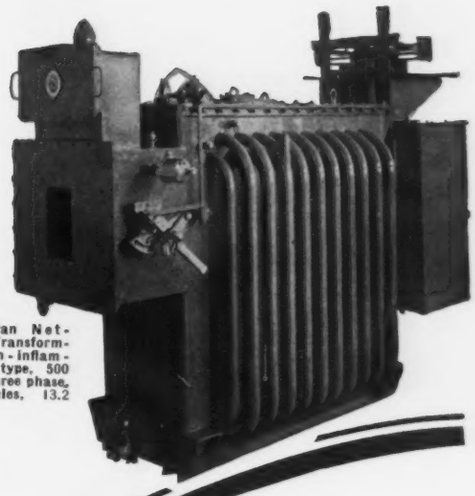
PUBLIC SERVICE CO. of COLORADO has filed with the Denver City Council a new rate reduction schedule, affecting some 50,000 to 60,000 electric light and power customers in Denver. Total annual savings to consumers will approximate $175,000, according to Guy W. Faller, Public Service president. All domestic electric customers in the City and County of Denver, using more than 40 kw.-hr. monthly will benefit. The minimum rate on light meters will continue to be 75 cents a month. Larger consumers will be the chief beneficiaries, balancing benefits awarded the small user in a 1939 electric rate reduction. The new schedule fixes the charge for the first 40 kw.-hr. at 5 cents per kilowatt-hour; 3½ cents per kilowatt-hour for the next 40 kw.-hr., and for all additional, 2 cents per kilowatt-hour. For electric water heater service, the company will charge 1 cent per kilowatt-hour, minimum $1.00 per month and limit use to off-peak hours. Charges for business lighting service applying to churches, schools and institutions were fixed as follows: first 200 kw.-hr., 5 cents per kilowatt-hour; next 200 kw.-hr., at 4½ cents per kilowatt-hour; next 600 kw.-hr. at 3½ cents per kilowatt-hour; next 1,000 kw.-hr. at 2½ cents per kilowatt-hour; next 2,000 kw-hr., at 1¾ cents per kilowatt-hour; all additional, 1¼ cents per kilowatt-hour. The rate reduction became effective January 1.

WASHINGTON WATER POWER CO. has reduced its electric rates for commercial customers $170,000. Approximately $90,000 of the total cut will be for commercial users in Spokane. Idaho Public Utilities Commission approved the new commercial rate schedule of the company in that state, bringing to customers an aggregate saving of $36,000.

LYNN GAS & ELECTRIC CO. has made a reduction in electric rates, totaling $60,000 minimum, effective January 1, and has instituted a more promotional gas rate schedule by order of the Massachusetts Department of Public Utilities. The city sought an electric rate cut of $163,900, but the commission pointed out that world uncertainties do not justify such an extended decrease in revenue. The net return on the company's electrical investment in



AmerTran Power Transformer, Type CC. Rated 10,000 Kva., single phase, 60 cycles, 125 Kv.



AmerTran Network Transformer, non-inflammable type, 500 Kva., three phase, 60 cycles, 13.2 Kv.

AMERTRAN

Proved THROUGH THE YEARS

TRANSFORMERS

AmerTran Distribution Transformer. Type RS. Sizes to 100 Kva., single phase, 60 cycles.

..in all RATINGS

..for all REQUIREMENTS

When purchasing an engineered product, give consideration to its nameplate. Wide experience of the manufacturer in his field is your best guarantee of dependability.

When selecting transformers you are assured of dependable performance if you specify AmerTran. These transformers are the product of an organization which has had forty years' experience in this specialized field and are available for every conceivable type of service in industrial and laboratory work in a complete range of ratings.* Listed among the hundreds of firms who have purchased this equipment year after year are many of this country's largest electric utility companies and leading industrials (names on request). This is further evidence of the wide acceptance of AmerTran Transformers.

Let us submit data on equipment to meet your particular requirements.

AmerTran Air-Cooled Transformer, Type CF, sizes 15 Kva. and smaller for outdoor service.

* 10,000 Kva. and smaller at 132 Kv. and below.

40th YEAR AMERTRAN

AMERICAN TRANSFORMER CO.

178 EMMET ST. NEWARK, N. J.

50TH BIRTHDAY

OF A ONE-MILE TUNNEL THAT REACHED AROUND THE WORLD

FIFTY YEARS ago the first large-scale development of hydroelectric power was inaugurated with the breaking of ground for the construction of a 6,700-foot tunnel, bored under what was then the village of Niagara Falls, in which the tailrace waters of one of the present hydroelectric plants on the American side of the Niagara River were to be discharged into the River below the Falls. The event also paved the way for the world's first transmission of electricity over long distances.

More significant than the actual breaking of ground for the tunnel itself, the event marked the engineering triumph of those early power pioneers who, in the face of nature's obstacles and over the skepticism of scientific men of their day, persisted in their ideas until ultimately they brought about abundant low-cost hydroelectric power that made the Niagara Frontier into the greatest electro-metallurgical and electrochemical center in the world.

The Niagara Hudson System—of which this great development is now a part—points with pride to the accomplishment of those Niagara pioneers, for their efforts were typical of the history of American business through which men of vision and courage have built a great country.

NIAGARA HUDSON

For a complimentary copy of "Niagara's Pioneers"—a 40-page illustrated booklet dealing with the thrilling story of the development of Niagara Power, write Niagara Hudson Power Corporation, 15 Broad Street, New York.

1939 was 8.38 per cent after depreciation reserve, that on the gas plant being 4 per cent. Fuel oil has cut heavily into the gas business. The board ruled that any reduction in rates at the sacrifice of proper depreciation charges would be unsound regulation. In its finding the commission recognized that the company faces increased operating costs of $63,500 per year due to higher fuel, labor and taxation; an increase of $100,000 in the state corporation tax (now appealed), and has suffered the loss of power sales to the defunct Boston, Revere Beach & Lynn electrified railroad.

PLYMOUTH COUNTY ELECTRIC CO., Plymouth, Mass., has filed a new schedule of rates, effective January 1, with the state Department of Public Utilities. It provides for reductions totaling $49,000 a year to all-year and seasonal residential customers.

CRESSON ELECTRIC LIGHT CO., and its associates, Gallitzin Electric Light Co. and Hastings Electric Co., has set up new tariffs designed to save customers approximately $10,500 a year, the Pennsylvania Public Utility Commission has announced. These companies are controlled by the Pennsylvania Coal & Coke Corp. The bulk of the reduction goes to residential users. The monthly minimum is reduced from $2 to $1. Cresson Electric reduction totals $5,605, distributed as follows: residential, $3,128; commercial, $2,211, and street lighting, $266. Gallitzin Electric reduction totals $3,273 a year, distributed as follows: residential, $2,437; commercial and industrial, $636, and street lighting, $200. Hastings Electrical Co. reduction totals $1,627, distributed as follows: residential, $1,278; commercial and industrial, $249, and street lighting, $100.

WISCONSIN PUBLIC SERVICE COMMISSION in its biennial report made recently to Governor Julius P. Heil, declared that during the two-year period from July 1, 1938 to June 30, 1940, it had ordered or authorized rate reductions totaling $1,728,000 a year for 400,000 utility customers. According to the report, 151,412 customers of electric utilities had their rates reduced $725,361 during the year July 1, 1938 to June 30, 1939, while 219,550 electric customers had their rates reduced $811,468 in the year July 1, 1939 to June 30, 1940.

•

Canadian Utility Cuts Dividend on Common

At a recent meeting of directors of Power Corporation of Canada, held in Montreal, an interim dividend of 15 cents per share on the company's common stock was declared for the six-month period ending December 31, 1940. This dividend is payable February 1 to record December 31, 1940.

For the past three years semi-annual dividends at the rate of 30 cents per share have been declared and the reduction to 15 cents per share is due, according to an official statement, to the payment of American exchange on the company's outstanding debentures, increased taxation and to the reduction in dividends on Canada Northern Power Corp. common stock.

FOR VAULT AND MANHOLE PROTECTION

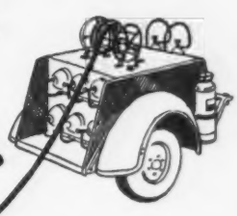
HOW do you handle underground fires? What do you do about trouble in manholes and underground transformer vaults?

Get a fire extinguisher that reaches deep down, whose penetrating power extends to every inch of vault or manhole, and which can kill fire even in inaccessible ducts.

This newest type LUX trailer unit is engineered for these hard-to-fight fires. Heavy barrage against fire is supplied by the six 50-pound LUX carbon dioxide cylinders equipped with a 100-ft. hosereel and heavy-duty nozzle. Individual cylinder controls permit discharge of a single cylinder or an entire broadside of 300 lbs. of carbon dioxide gas. Small portables are carried, too.

Hook this new LUX unit onto an emergency truck, and you're ready for underground fires. Fast-expanding LUX gas has the "reach" to travel a hundred or more feet and kill duct fires . . . has the wallop to smother the hottest vault or manhole fire.

Get one of these mobile fire-killers in your garage. Write now—and we will send full details by return mail.

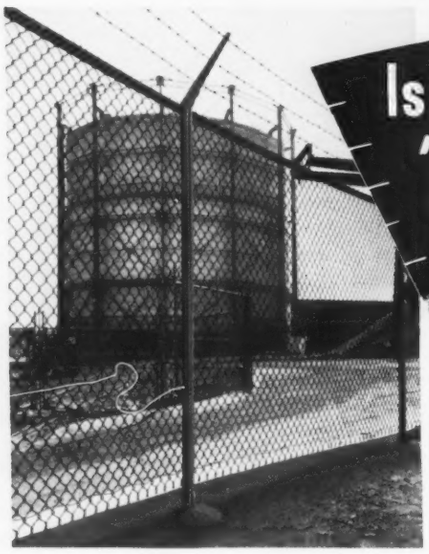


LUX
SNUFFS OUT FIRE

Walter Kidde & Company, Inc.

128 West St., Bloomfield, N. J.

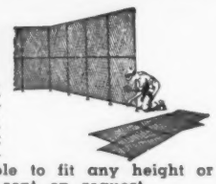
IF YOU DO ANY BENDING WORK...
YOU CAN USE THIS FREE BOOKLET
Greenlee
BENDERS
for
PIPE
RIGID CONDUIT
THIN-WALL CONDUIT
STEEL, BRASS, and COPPER TUBING
BUS-BARS
GREENLEE TOOL CO.
ROCKFORD ILLINOIS
Just off the press . . . the new 12-page Greenlee Bender Booklet to help you with your bending problems. Whatever you have to bend . . . tubing, conduit pipe, or bus-bars . . . there is a Greenlee Bender to do the job easier and faster for you. This booklet with a detailed description of the complete line of Greenlee Benders and attachments, will help you select the right bender for your job. Send for your free copy today!
GREENLEE TOOL CO.
1705 Columbia Ave., Rockford, Ill.



● A Stewart Non-Climbable, Crashproof Chain Link Wire Fence is the best insurance against sabotage you can buy. Here's why. ALL BEAM construction (solid open section line posts, terminal posts and top rail) exclusive with Stewart, is the heaviest and strongest chain link wire fence structure manufactured and is admittedly far superior to pipe or a combination of pipe and beam. To fully appreciate this type of construction you are invited to inspect various Stewart Beam sections. Actual samples gladly furnished for your examination.

Send for free Specification Book 79 showing typical installations, constructional details, sizes, materials and other information.

WIRE MESH PARTITIONS



Provide economical enclosures. Allow maximum light and ventilation. Stewart partitions are sectional and available to fit any height or width. Literature sent on request.

Stewart IRON and WIRE FENCES

Sales and Erection Service Everywhere

THE STEWART IRON WORKS CO., INC.
801 STEWART BLOCK
CINCINNATI, OHIO

Sales Opportunities

KNOXVILLE, TENN. — Tennessee Valley Authority, Knoxville, has authorized new 154,000-volt transmission line from connection with main high-tension system from Hiwassee Dam hydroelectric station to Alcoa, Tenn., where service will be furnished for mills of Aluminum Company of America, Inc. Also will make other line extensions in same area. Power substation terminal will be arranged at Alcoa for industrial power supply noted. Entire project will cost close to $850,000. Work is scheduled to begin soon.

CLEVELAND, OHIO—Otis Steel Co., 3341 Jennings Street, plans installation of motors and controls, switchgear, transformers and accessories, turbo-blowers, electric hoists, conveyors and other equipment in connection with expansion and improvements in local Riverside steel works. New high-pressure boilers will be installed at blast furnaces. Entire project will cost about $750,000. Work will be carried out at early date.

MAQUOKETA, IOWA—City Council receives bids until January 31 for new diesel engine-driven electric generator and auxiliary equipment, for installation in municipal electric power station, where expansion and improvements will be made.

LOS ANGELES, CALIF.—Los Angeles Bureau of Power and Light, 207 South Broadway, plans new power substation on Venice Boulevard, to be known as Receiving Station D, with line connections with high-tension system. Cost estimated about $1,365,000, of which $1,150,000 will represent equipment purchases. This is part of 1941 expansion program of Bureau.

SUPERIOR, WIS.—Superior Water, Light & Power Co. has plans under way for new steam-electric generating station on local site at Hughitt Avenue and Second Street. Cost estimated close to $1,000,000, with turbine-generator units, high-pressure boilers and auxiliary equipment. Proposed to carry out work early this year.

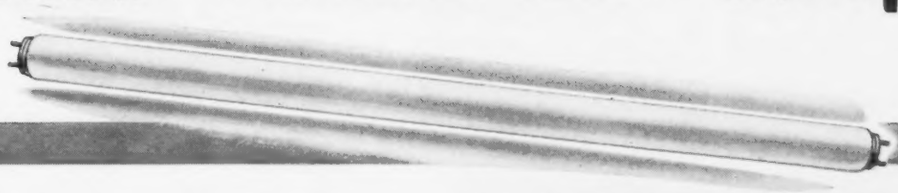
GREENFIELD, MASS.—Greenfield Tap & Die Corp., manufacturer of gages, taps, dies and kindred tools, plans installation of motors and controls, switchgear, duct lines, industrial lighting facilities, conveyors and other equipment in new one-story plant additions for production of gages for War Department. Cost about $1,000,000. Work will be placed under way soon.

LITTLE ROCK, ARK.—United States Engineer Office, Little Rock, receives bids until January 29 for 10 motor-driven vertical pumping units, with controls and accessory equipment, divided into three allotments: Lot No. 1—one 3,000-gallon per minute capacity, volute-type trash pump, and two 750-gallon per minute, volute-type sewage pumps; Lot No. 2—Two 25,000-gallon per minute, two 15,000-gallon per minute, and two 10,000-gallon per minute, single stage, propeller-type pumps; and Lot No. 3—One 20-gallon per minute capacity centrifugal sump pump, complete with float switch, etc.

CHICAGO, ILL. — Commonwealth Edison Co. has taken out a permit for extensions and improvements in switching station at 1111 West Cermak Road.

NEW BRUNSWICK, N. J.—Public Service

NO WONDER BUSINESS EVERYWHERE IS TURNING TO WESTINGHOUSE *Mazda* FLUORESCENT *Lamps*



READ THE REASONS!

1. Westinghouse Mazda F Lamps make possible HIGHER LEVELS OF ILLUMINATION.

2. They provide GOOD DIFFUSION and PROPER DISTRIBUTION OF LIGHT for better seeing and working conditions.

3. They are COOL—producing about ¼th the radiant energy per unit of light.

4. They are offered in RICH NEW COLORS—Red, Pink, Blue, Green, Gold, as well as WHITE, making them ideal for display and decorative purposes.

5. Amazing NEW DAYLIGHT SHADE is the closest practical approach to natural outdoor daylight.

6. Westinghouse Mazda F Lamps permit better lighting in older buildings where additional wiring is impractical and costly.

7. TUBULAR SHAPE of lamps provides freedom for any type of architectural treatment of lighting design. The lamp of the future—TODAY!

8. Their distinctive colors and streamlined shape make Westinghouse Mazda F Lamps excellent "silent salesmen" when used for attracting attention to merchandise displays.

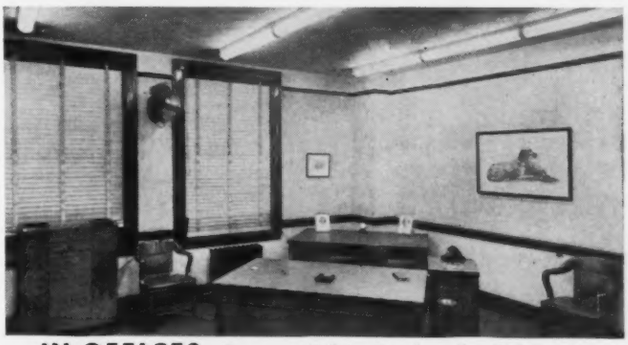
New Lower Prices Effective January 1st!

Once AGAIN prices of Westinghouse Mazda Fluorescent Lamps are reduced—thanks to the constantly increased demand for this modern light source.

Fluorescent Daylight and 3500° White Lamps

WATTAGE	BULB SIZE	OLD PRICE	NEW PRICE
15	18" T-8	$ .95	$ .85
20	24" T-12	1.25	1.10
30	36" T-8	1.25	1.10
40	48" T-12	1.90	1.60
100	60" T-17	3.75	3.50
Soft White, Blue, Green and Pink Fluorescent Lamps			
15	18" T-8	$1.05	$ .95
20	24" T-12	1.35	1.20
30	36" T-8	1.35	1.20
Gold and Red Fluorescent Lamps			
15	18" T-8	$1.15	$1.05
20	24" T-12	1.45	1.30
30	36" T-8	1.45	1.30

See Your Local Westinghouse Mazda Lamp Distributor



IN OFFICES, *fluorescent lighting is soft, cool and pleasant to work under*

IN FACTORIES, *fluorescent lighting provides high levels of glareless, shadowless light.*

★

IN STORES, *the rich, glowing colors of fluorescent lighting enhance any decorative scheme.*

Westinghouse FLUORESCENT LIGHTING

Presents

DURAPOLE

WESTERN RED CEDAR

The pole with extended service life above the ground

..for sterilization of sapwood

..for uniform light brown permanent color

..for attractive appearance

One of the numerous improvements which V has added to its pole manufacture is FULL LENGTH TREATMENT of machine shaved poles. This sterilizes the remaining sapwood and thus increases life in line and prevents decay in storage. Additional pole life is also attributed to thorough creosote treatment of checks, tops, gains, and bolt holes. V designed and built a special treating plant used only for full length treatment in special AWPA grade #1 heated creosote. DURAPOLES are not gummy and will not bleed; the resultant light brown color effects much improved pole appearance.

You get all these features when you specify

DURAPOLE

Slab Gained—for perfect drainage, for secure arming—for much better appearance.

Full length treated—for sterilization of sapwood—for uniform light brown permanent color—for attractive appearance.

Machine shaved—for increasing life of the pole above the ground for improved appearance.

Butt treated ½" guaranteed penetration—no reduction of sapwood in butt section.

VALENTINE CLARK CORPORATION

2516 DOSWELL AVE. ST. PAUL, MINN.

Dwight Building, Kansas City, Mo. — 84 William St., New York City

Electric & Gas Co., Newark, N. J., plans new power substation in North Brunswick Township, near New Brunswick, primarily for increased power supply for industrial plants in that area. A new power substation also is planned at New Milford, Bergen County. Line extensions will be made in both districts. Company will make additions and improvements in power substation at Rutherford, particularly for distribution service. Work noted will comprise part of 1941 expansion program of company.

PENSACOLA, FLA.—Diraplane Manufacturing Corp., Carry Building, 927 Fifteenth Street, N.W., Washington, D. C., manufacturer of aircraft, plans installation of motors and controls, duct lines, switchgear, transformers and accessories, industrial lighting facilities, air-conditioning system, conveyors, electric hoists and other equipment in new plant at Pensacola, where site has been selected. It will consist of several one-story units, totaling about 231,000 square feet of floor space. Cost reported close to $750,000. Proposed to begin work soon.

KNOXVILLE, TENN.—Director of Purchases, Tennessee Valley Authority, Knoxville, receives bids until January 20 for one 300-kva. gasoline engine-operated electric generating unit and accessories, for installation at Watts Bar hydroelectric generating station.

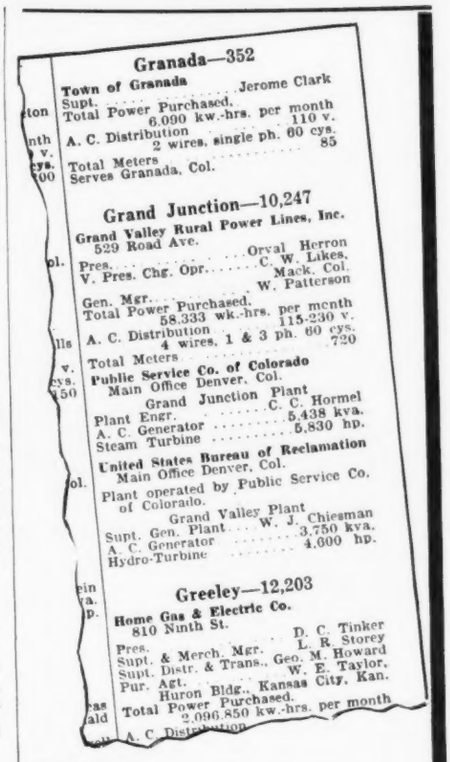
RALEIGH, N. C.—Carolina Power & Light Co. has plans under way for new steam-electric generating station on site in city area now being selected, with installation of 40,000-hp. steam turbine-generator unit, high-pressure boilers and auxiliary equipment. Contract is being placed for turbine and awards will be made soon for boilers, condensers and auxiliary equipment. New switchyard will be constructed and extensions made in transmission and distributing lines. Cost estimated close to $3,000,000.

FARMINGDALE, N. Y.—Liberty Aircraft Products Corp., Farmingdale, L. I., manufacturer of airplane parts and specialties, plans installation of motors and controls, switchgear, duct lines, industrial lighting facilities, conveyors, electric hoists and other equipment in new one-story additions for production service for Navy Department, Washington, D. C. Fund of about $1,088,000 will be provided by Government for project on which work will proceed at early date.

CELINA, OHIO—Village Council plans call for bids before close of this month for extensions and improvements in municipal electric power station, including new building, 60x125 feet, and installation of equipment. O. L. Beiswenger, RD. No. 2, Everett, Ohio, is consulting engineer.

MIAMI BEACH, FLA.—Florida Power & Light Company, Miami, has approved plans for new power substation at Normandy Beach, near Miami Beach, and will proceed with erection at once. Also will make extensions in transmission lines to connect with new unit.

WAUWATOSA, WIS.—Board of Public Works plans immediate call for bids for equipment for ornamental street-lighting system on Jackson Park Boulevard, from North Eighty-first to North Ninetieth Street; on Wauwatosa Avenue, from West North Avenue to Northern city limits; and on section of Ludington Avenue, including poles, fixtures, cable, etc. Edward Whittier is city purchasing agent.



Granada—352
Town of Granada
Supt. ..... Jerome Clark
Total Power Purchased, 6,090 kw.-hrs. per month
A. C. Distribution 2 wires, single ph. 60 cys. 110 v. 85
Total Meters
Serves Granada, Col.

Grand Junction—10,247
Grand Valley Rural Power Lines, Inc.
529 Road Ave.
Pres. ..... Orval Herron
V. Pres. Chg. Opr. ..... C. W. Likes.
Gen. Mgr. ..... Mack. Col. W. Patterson
Total Power Purchased, 58,333 wk.-hrs. per month
A. C. Distribution 4 wires, 1 & 3 ph. 60 cys. 115-230 v. 720
Total Meters
Public Service Co. of Colorado
Main Office Denver, Col.
Grand Junction Plant
Plant Engr. ..... C. C. Hormel
A. C. Generator ..... 5,438 kva.
Steam Turbine ..... 5,830 hp.
United States Bureau of Reclamation
Main Office Denver, Col.
Plant operated by Public Service Co. of Colorado.
Grand Valley Plant
Supt. Gen. Plant ..... W. J. Chiesman
A. C. Generator ..... 3,750 kva.
Hydro-Turbine ..... 4,000 hp.

Greeley—12,203
Home Gas & Electric Co.
810 Ninth St.
Pres. ..... D. C. Tinker
Supt. & Merch. Mgr. ..... L. R. Storey
Supt. Distr. & Trans. ..... Geo. M. Howard
Pur. Agt. ..... W. E. Taylor, Huron Bldg., Kansas City, Kan.
Total Power Purchased, 2,096,850 kw.-hrs. per month
A. C. Distribution

THIS just gives you a quick idea of the completeness of the listings in the 1940 Central Station Directory. Check it over and see what **more** information you could want to make up market analyses . . . to help salesmen or representatives see the **right** person . . . or for quick reference for that particular bit of information you need. The Central Station Directory is a veritable encyclopedia, one that will save you dollars, cents and time.

●

CLIP THE COUPON TO ORDER YOUR COPY TODAY

McGRAW-HILL PUBLISHING CO., INC.
Catalog and Directory Division
330 West 42nd St., New York, N. Y.

Gentlemen: You may mail us .....copies of the 1940 McGRAW CENTRAL STATION DIRECTORY. Deliver to the following address and bill us at the rate of $25.00 per copy. (10% discount on 5 or more copies.

(Company) .....

(Address) .....

.....

(Signed) .....
NAME TITLE

At the POWER SHOW-*Did you notice*

Five

FAMOUS VALVE MANUFACTURERS PROMINENTLY DISPLAYED the

PHILADELPHIA

Limitorque

VALVE CONTROL!

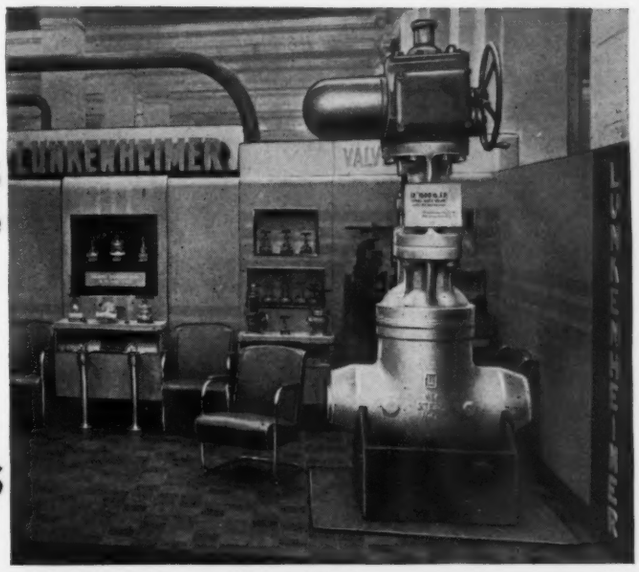
Write for LIMITORQUE Catalog

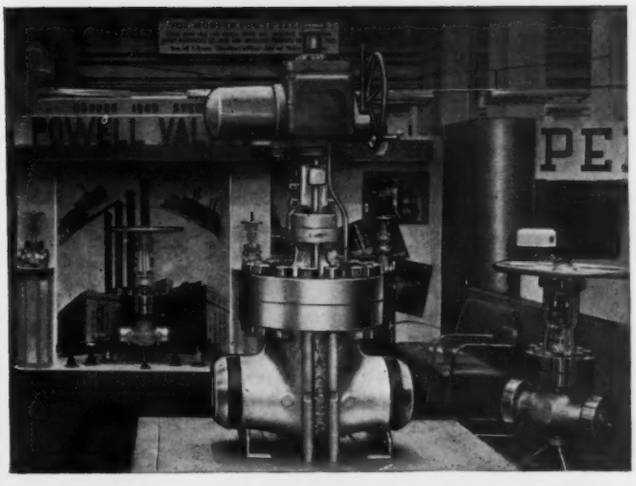
PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducers

Erie Avenue and G Street, Philadelphia, Pa.

NEW YORK • PITTSBURGH • CHICAGO





Sherman SPLICING SLEEVES

For All Cable and Wire Needs

Above — Figure 8 Double Tube Sleeve.

At left — Split Tinned Sleeve, for underground cables.

At right — Seamless Oval Type Sleeve.

Only the finest of materials are used in Sherman Splicing Sleeves, and they are made by precision methods that assure freedom from burrs and other defects.

Made in a wide variety of styles, to satisfy practically all cable or wire splicing requirements, these sleeves fully comply with N.E.L.A. specifications.

Write for Trade Bulletin 20 illustrating and describing the complete line of Sherman Sleeves. Let us send you free sample for your own tests.

H. B. SHERMAN MFG. CO. . . . *Battle Creek, Mich.*

NEW BOOK

Electric Distribution Fundamentals

Just Out

SHOWS HOW TO SOLVE

the problems of design, construction, operation, service, methods, equipment, mechanics, and materials of electric distribution

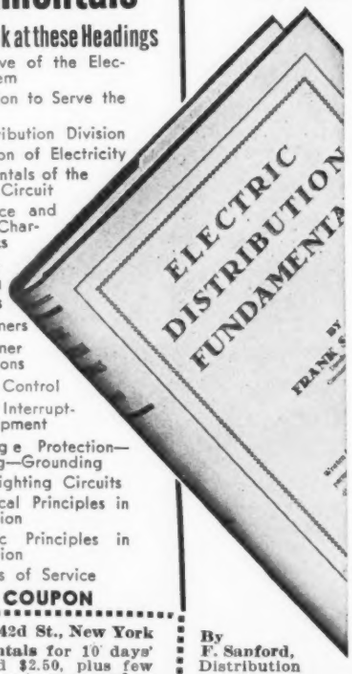
From a non-engineering viewpoint, this book outlines features of both utility distribution and the industrial and inside wiring branches of service to the outlet.

THE ABC OF ELECTRIC DISTRIBUTION

Tells how the distribution system is designed and built, how it works, and how it is serviced and operated; explains equipment and its use, design of carrying lines, problems of maintaining flow, and materials; discusses how distribution fits in economically with the general system of electric supply; covers voltage drop, wire size calculation, power factor, etc., etc. Practical design problems are included with solutions based on diagrams instead of difficult mathematics.

Look at these Headings

- Perspective of the Electric System
- Distribution to Serve the Load
- The Distribution Division
- Generation of Electricity
- Fundamentals of the Electric Circuit
- Inductance and Related Characteristics
- Tools for Electrical Problems
- Transformers
- Transformer Connections
- Voltage Control
- Current Interrupting Equipment
- Voltage Protection—Lightning—Grounding
- Street Lighting Circuits
- Mechanical Principles in Distribution
- Economic Principles in Distribution
- Measures of Service



By F. Sanford, Distribution Engineer, Cincinnati Gas & Electric Co.

242 pages
156 illustrations
15 tables
1 chart

$2.50

10 DAYS' FREE EXAMINATION—MAIL COUPON

McGRAW-HILL BOOK COMPANY, Inc., 330 West 42d St., New York

Send me Sanford's **Electric Distribution Fundamentals** for 10 days' examination on approval. In 10 days I will send $2.50, plus few cents postage, or return book postpaid. **(We pay postage on orders accompanied by remittance.)**

Name .....
Address .....
City and State .....
Position .....
Company W-1-11-41

(Books sent on approval in U. S. and Canada only.)

Allots $9,133,500 to 71 Power Systems

Allotments totaling $9,133,500 for rural electrification in 28 states were recently announced by Harry Slattery, Administrator of Rural Electrification. These allotments provide for the establishment of seven new power systems, the enlargement of 58 co-operatives, four public districts in Nebraska and one private utility, and the construction of an electric refrigeration plant.

This brings allotments made by REA since it was established in 1935 to $351,454,621, of which $82,080,500 represents operations of the current fiscal year.

Among the recent allotments are the following:

ALABAMA—Black Warrior Electric Membership Corp., Demopolis, Frank L. Holman, supt., $325,000 to build 458 miles of line, 1,136 members in Choctaw, Pickens, Greene, Tuscaloosa, Hale, Sumter, Marengo, Clarke and Perry counties. Central Electric Refrigeration Co-operative, Grove Hill, G. L. Wahtley, correspondent, $27,500 for construction of electric refrigeration plant.

ARIZONA—Stonewall Electric Co., 81 North Stone Av., Tucson, M. A. Pooler, manager, $35,000 to build 41 miles of line, 60 members in Pima County.

CALIFORNIA—Mountain Empire Electric Co-operative, Inc., Campo, L. N. Miller, supt., $20,000 to build 19 miles of line, 115 members in San Diego County.

COLORADO—High Line Electric Association, Holyoke, T. G. Puryear, supt., $166,000 to build 190 miles of line, 295 members in Phillips, Yuma and Sedgwick counties, Colorado, and Chase and Deuel counties, Neb.

FLORIDA—Talquin Electric Co-operative, Inc., Quincy, D. A. Avant, president, $214,000 to build 262 miles of line, 681 members in Gadsden, Leon, Liberty and Jefferson counties. Choctawhatchee Electric Co-operative, Inc., DeFuniak Springs, G. C. Johnson, president, $290,000 to build 348 miles of line, 1,143 members in Walton, Okaloosa and Holmes counties.

GEORGIA — Snapping Shoals Electric Membership Corp., Covington, Homer Cook, supt., $59,000 to build 65 miles of line, 215 members in DeKalb, Newton, Butts, Rockdale and Henry counties.

IDAHO—Long Valley Power Co-operative, Lake Fork, Oscar Erickson, president, $119,000 to build 113 miles of line, 323 members in Valley County.

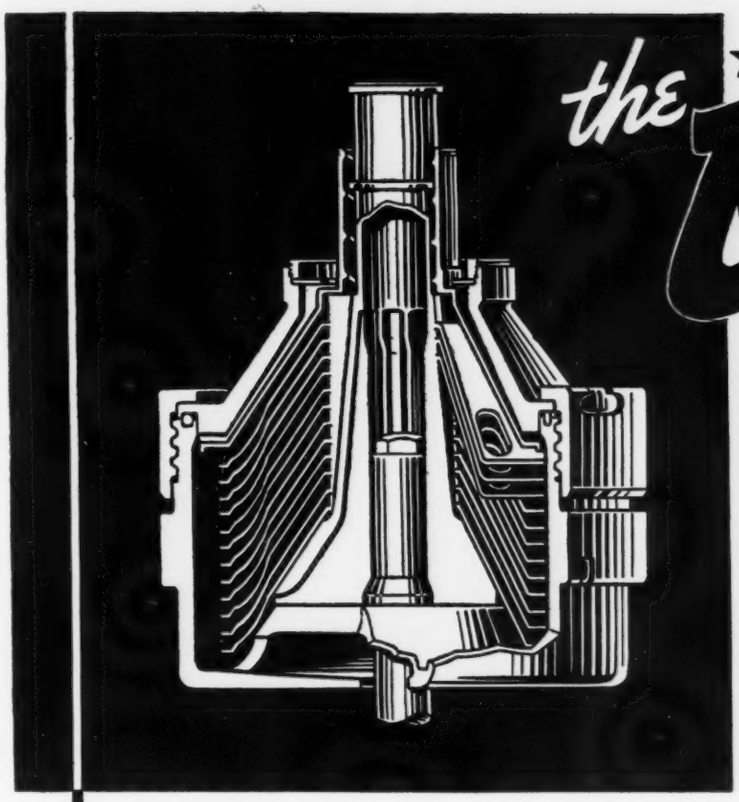
INDIANA—Marshall County REMC, Plymouth, Clayton Robinson, manager, $65,000 to build 67 miles of line, 193 members in Kosciusko, Fulton, Starke, St. Joseph and Marshall counties.

IOWA—Maquoketa Valley Rural Electric Co-operative, Anamosa, Edgar D. Beach, manager, $264,000 to build 344 miles of line, 803 members in Jones, Delaware, Dubuque, Linn, Jackson and Clayton counties.

KANSAS—Arkansas Valley Electric Co-operative Association, Inc., Sterling, Alvia B. Davis, supt., $335,000 to build 407 miles of line, 836 members in Ellsworth, Rice, McPherson, Reno, Stafford and Kingman counties.

KENTUCKY — Henderson-Union Rural Electric Co-operative Corp., Henderson, John R. Hardin, supt., $120,000 to build 129 miles of line, 429 members in Hender-

IN AN OIL PURIFIER



the ★ BOWL is the thing

★ Discs in the De Laval Oil Purifier bowl stratify oil into thin sheets so that it is more easily and, hence, more completely purified. This principle has been applied in building De Laval bowls since 1890—twelve years after the invention of the first centrifugal separator by Dr. De Laval.

More impurities—and more different kinds of impurities—can be removed from oil by centrifugal force than by any other method. But the ultimate efficiency of centrifugal purification is realized only when the bowl, or purifying member, is skillfully designed to increase the effectiveness of centrifugal force.

Fifty years ago De Laval learned the secret of really harnessing centrifugal force to do a *better job.* The present, highly perfected De Laval disc type of bowl, which provides greater efficiency and capacity at lower speed—both uniformly maintained throughout long runs—is the result.

Look to the bowl of the oil purifier for results you wish to secure. A more efficient bowl—a De Laval bowl—keeps insulating oil in better condition, gives oil-immersed apparatus increased protection and thereby helps assure sub-station performance that is both dependable and economical.

Write for Bulletin No. 107.

De Laval

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York, 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal Peterborough Winnipeg Vancouver

OIL PURIFIERS

Made By The Company That Pioneered Dropout And Reclosing Fuses

Southern States'

Secondary Fuses

Will Not Blow Prematurely

The *full rated load* of each Southern States' Secondary Fuse *is carried throughout its life.* Even when subjected to overloads that do not last long enough to rupture it, the fusible element remains undamaged and continues to carry its full load until an overload of sufficient duration to blow it occurs.

Southern States' Secondary Fuses will not short or ground adjacent phases. A stainless steel spring adds extra separation when the element ruptures. Southern States' Secondary Fuses are fully indicating. They are available in three speeds and will fit in with your coordination plans.

Ask your Southern States representative to tell you more, or write for Bulletin 190 that gives complete information and shows typical applications of Southern States' Secondary Fuses.

Write for Bulletin 190 Today

Send for Your Copy of This Coordination Handbook

This helpful handbook contains interrupting capacities of all Southern States' fuses (single-shot and reclosing), time-current characteristics of all Southern States' fuse links, and complete coordination data. Simply put your name and address on a post card and say you want your copy of *Fuse Characteristics and Coordination Data.* We will send it to you immediately.

Write for Your Copy Now

Southern States

Equipment (SS) Corporation

28 S. 20th St. Birmingham, Ala.

Canadian Representative:
Dominion Cutout Co., Ltd., Toronto

LOUISIANA—Bossier Rural Electric Membership Corp., Bossier, B. H. Allen, supt., $121,000 to build 147 miles of line, 378 members in Bossier, Bienville and Webster Parishes.

MAINE—Kingman Electric Co., Kingman, Ivan L. Wyman, manager, $23,000 to build 17 miles of line, 81 members in Penobscot County.

MARYLAND—Choptank Co-operative, Inc., Denton, C. A. Sennett, supt., $572,000 to build 635 miles of line, 1,687 members in Wicomico, Dorchester, Caroline, Queen Annes, Talbot, Worcester and Somerset counties.

MICHIGAN — Ontonagon County Rural Electrification Assn., Ontonagon, Cyril M. Clark, supt., $60,000 to build 73 miles of line, 171 members in Ontonagon, Houghton and Baraga counties.

MINNESOTA—McLeod Co-operative Power Assn., Glencoe, R. A. Fischer, manager, $126,000 to build 153 miles of line, 403 members in McLeod, Sibley, Carver and Renville counties.

MISSISSIPPI—Yazoo Valley Electric Power Assn., Yazoo City, C. N. Blakemore, supt., $20,000 to build 40 miles of line, 78 members in Yazoo, Holmes, Sharkey and Warren counties.

MONTANA—Sun River Electric Co-operative, Inc., Fairfield, R. C. Sherman, supt., $155,000 to build 175 miles of line, 301 members in Teton, Pondera and Cascade counties.

NEBRASKA—Dawson County Public Power District, Lexington, Thomas C. Guilfoyle, supt., $400,000 to build 403 miles of line, 669 farms, 140 pumps, a pumice plant and 33 consumers in the Village of Wellfleet. The lines extend into Dawson, Lincoln, Frontier, Gosper and Custer counties.

NORTH CAROLINA — Burke-McDowell Electric Membership Corp., Morgantown, W. R. Mullis, president, $159,000 to build 170 miles of line, 708 members in Burke, McDowell and Caldwell counties. Carteret-Craven Electric Membership Corp., Beaufort, A. L. Hamilton, Attorney, $143,000 to build 145 miles of line, 542 members in Craven and Carteret counties.

NORTH DAKOTA—Tri-County Electric Co-operative, Inc., Glenfield, L. H. Shaw, manager, $153,000 to build 206 miles of line, 450 members in Foster, Stutsman, Wells, Kidder, Griggs and Eddy counties.

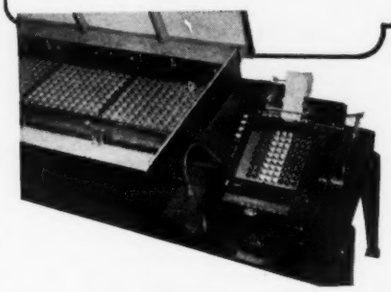
OHIO — Guernsey-Muskingum Electric Co-operative, Inc., New Concord, H. B. Smith, supt., $161,000 to build 155 miles of line, 389 members in Morgan, Noble, Guernsey, Muskingum and Tuscarawas counties.

OKLAHOMA — Canadian Valley Electric Co-operative, Inc., Seminole, O. Jameson, president, $218,000 to build 231 miles of line 770 members in Pottowatomie, Seminole, Lincoln, Okfuskee and Hughes counties.

SOUTH CAROLINA — Pee Dee Electric Co-operative, Inc., Darlington, T. R. Boseman, supt., $252,000 to build 297 miles of line, 1,075 members in Florence, Darlington, Lee and Chesterfield counties. Salkehatchie Electric Co-operative, Inc., Barnwell, R. R. Johnston, president, $157,000 to build and acquire 154 miles of line, 559 members in Barnwell, Aiken and Allendale counties.

TEXAS—Farmers' Electric Co-operative, Inc., Greenville, Charles M. Curfman, supt., $192,000 to build 233 miles of line, 857 members in Dallas, Rockwall, Collins, Hunt, Rains, Kaufman, Hopkins, Delta and Franklin counties.

Saved more than $2500. in making an accurate bill analysis



The One-Step Method of Bill Analysis . . .

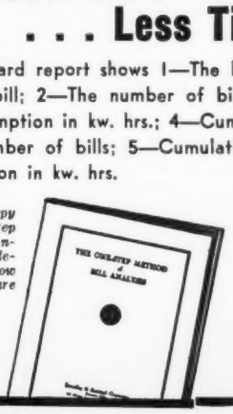
The reason the R & S one-step method of bill analysis costs you only a fraction of a cent per item is because greatly simplified procedure enables us to provide you with accurate information in a minimum of time. Wherever Customer Usage Data at lower cost . . . in less time . . . is wanted, the R & S Method of bill analysis will give it to you.

Customer Usage Data Lower Cost . . .

. . . Less Time

The standard report shows 1—The kw. hrs. per bill; 2—The number of bills; 3—Consumption in kw. hrs.; 4—Cumulative number of bills; 5—Cumulative consumption in kw. hrs.

Write for your copy of "The One-Step Method of Bill Analysis" which describes briefly how these savings are made.



RECORDING & STATISTICAL CORPORATION

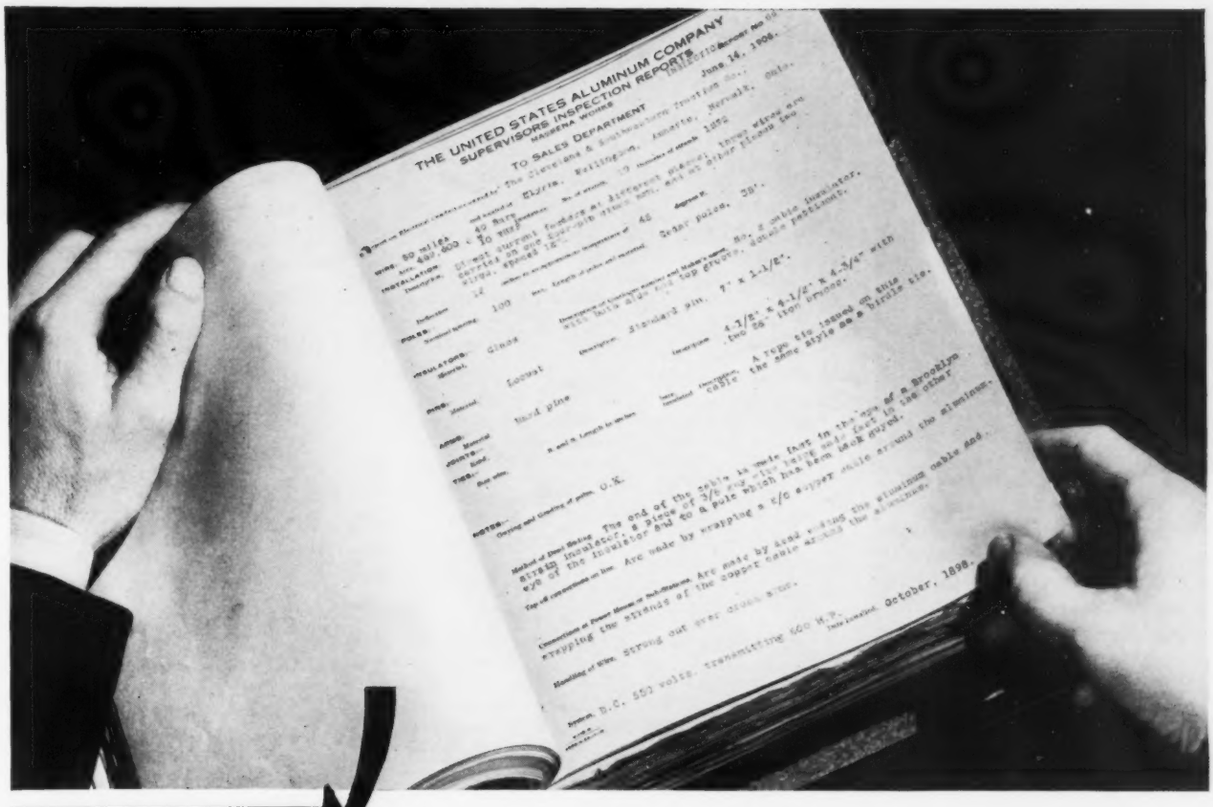
Utilities Division

102 MAIDEN LANE, N. Y.

BOSTON • CHICAGO • DETROIT

MONTREAL • TORONTO

"I *helped make* Conductor History



DEFENSE COMES FIRST

To meet the needs of the National Defense Program, plus the normal demands of peace, a vast expansion of our already greatly increased production capacity is being speeded. When the emergency is past, there will be more Aluminum available than ever before.

Meanwhile, if you can't get all the Aluminum you want when you want it, remember Aluminum is helping you by helping to meet the National emergency. Aluminum Company of America, 2138 Gulf Bldg., Pittsburgh, Pa.

From the earliest days of Aluminum power lines, our engineers have been "in the field;" assisting designers and builders, studying the performance of finished lines. Observations were recorded in books like this.

Vitally important to industry was this study of the performance of these first Aluminum lines. Refinements responsible for the great dependability of present-day power lines were based on such on-the-job records.

A.C.S.R. evolved as the use of longer spans required higher strength conductors. Suitable accessories and construction methods have been developed and proved, even including a perfected system of vibration control.

ALCOA ALUMINUM

Reg. U. S. Pat. Off.

A·C·S·R

Aluminum Cable Steel Reinforced

FOR HIGH VOLTAGE TRANSMISSION and RURAL POWER LINES

....Hold Everything!

That tower was erected in jig time. And it's up to stay because the ANCO-NUTS are *on* to stay. Vibration or shock cannot possibly loosen them—only a stout heave on an ordinary wrench can do that.

ANCO-NUTS

are used by the millions in steel tower construction because nut and locking device are a single unit—They're fool-proof, no matter how unskilled the labor—They're comparable in price to the ordinary nut and lock washer, but far more secure and efficient — Furnished in all practical metals, plain, galvanized or plated. Threads are U.S.S., S.A.E. or Whitworth as specified. Write us today for complete data and samples.

• • •

AUTOMATIC NUT COMPANY, INC.

LEBANON, PENNA.

VIRGINIA—Virginia Electric Co-operative, Bowling Green, W. H. Brown, manager, $172,000 to build 179 miles of line, 523 members in Essex, King and Queen, King William, Caroline, Spotsylvania, Louisa and Orange counties.

WASHINGTON — Inland Empire Rural Electric, Inc., Spokane, D. I. Hopkins, president, $566,000 to build 700 miles of line, 1,066 members in Spokane, Stevens, Whitman, Garfield and Asotin counties.

Construction contracts recent approved included the following:

TENNESSEE — Appalachian Electric Co-operative, Jefferson City, Kenneth B. Metcalf, supt., and T. R. Hunnicutt, Knoxville, Tenn., engineer, contract to Forcum James Co., Dyersburg, Tenn., 271 miles of line, 935 members; bid, $187,983.

TEXAS—Comanche County Electric Co-operative Assn., Comanche, Arthur C. Thomas, supt., and Freese and Nichols, Fort Worth, Tex., engineer, contract to J. E. Morgan and Sons, Waco, 277 miles of line, 512 members; bid, $135,454.

VIRGINIA—B.A.R.C. Electric Co-operative, Millboro, M. R. Seabrooke, supt., and engineer, contract to Rockingham Construction Co., Harrisonburg, 194 miles of line, 400 members; bid, $139,788.

WASHINGTON — Public Utility District No. 1 of Klickitat County, White Salmon, R. W. Beck, Inc., Portland, Ore., engineer, contract to Homer G. Johnson, Portland, Ore., 58 miles of line, 235 members; bid, $55,231.

WISCONSIN—Oakdale Co-operative Electrical Assn., Oakdale, Lloyd McCaskey, supt., and Wisconsin Development Authority, Madison, Wis., engineer, contract to Honold and LaPage, Inc., Sheboygan, Mich., 93 miles of line, 205 members; bid, $56,604.

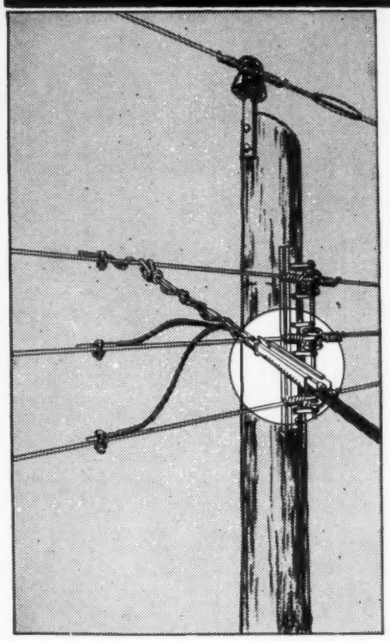
•

Aluminum Developments in Germany Reported

Approximately 20 per cent of the total German aluminum consumption at the beginning of 1939 was for electric cables and wires, chiefly for high-tension lines, according to *Electrical and Radio World Trade News*. At the end of 1938 the mileage of the Old Reich's high-tension lines was 31,400 kilometers, of which 18.7 per cent were of aluminum and 15.3 per cent of steel-aluminum.

Progress is also reported in the use of oxidized aluminum wires (by the "Eloxal" process) as a substitute for insulated copper wires, especially for coils which have to stand high temperatures. Refined aluminum in seamless tubes is used as a lead substitute for the armoring of cables installed in buildings. Use of laminated aluminum-copper-aluminum sheets plated on one side or both with copper, containing 70 and 80 per cent, respectively, of aluminum—for switches and other electrical purposes is likewise a recent development.

modernize YOUR DISTRIBUTION PRACTICE—

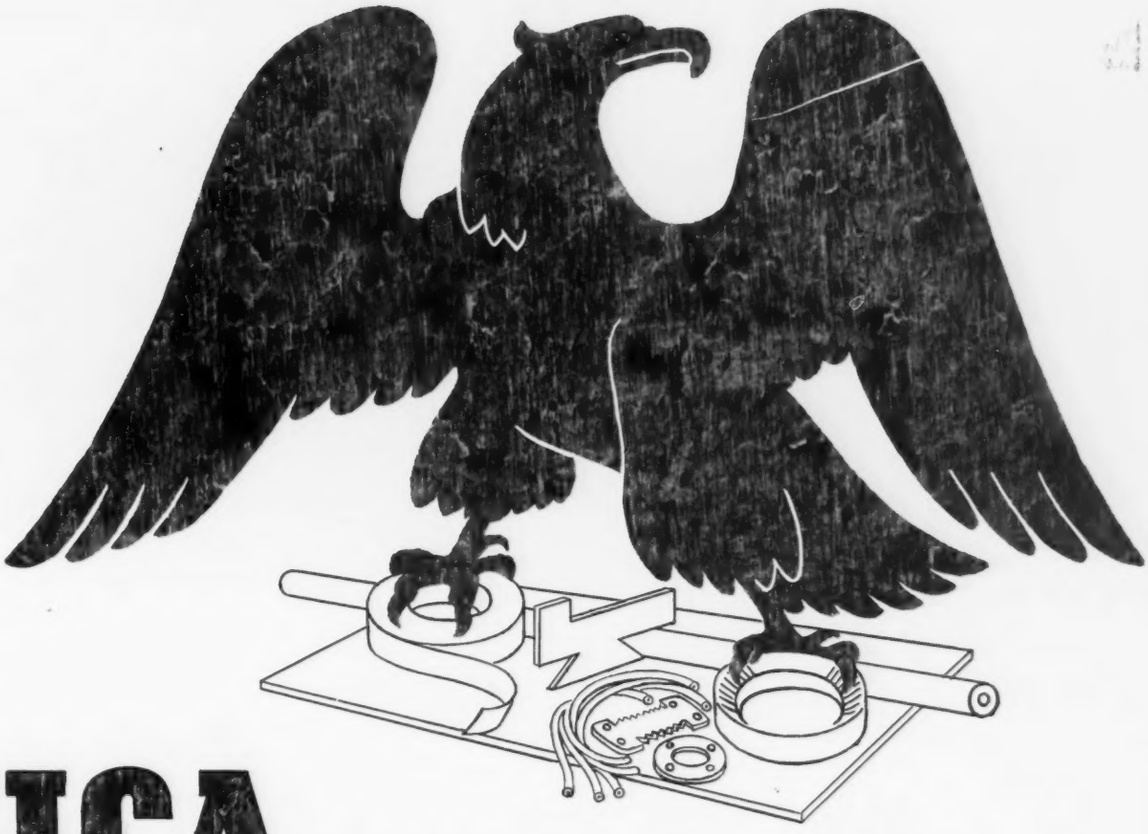


Residential area construction—showing single phase primary with attachment of service cable a couple of feet from pole to high strength common neutral wire.

RELIABLE CONCENTRIC CABLE CLAMPS

hold cable securely without bending or snubbing or otherwise damaging the insulation. Non-corrosive materials — easy to install — low in cost.

Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO ILLINOIS



MICA *answers the call with many insulations!*

As America's new mechanized Army equipment rumbles off the production line, spark plugs and electrical equipment must be sturdy and trouble-free—so they are Mica-insulated.

In the air—delicate radio equipment must be unfailing as well as shielded from interference—with Lamicoid. And at sea—great motors and generators must pack maximum power in minimum space—so they are insulated with Super-Micanite.

Mica is proud to play its part in furnishing these and a hundred more insulating accessories vital to the Preparedness Program. From actual fighting equipment to the machine tools and other machinery that produce it, products of Mica Insulator Company are speeding up mechanization by serving an unending variety of electrical insulating requirements.

In most cases, these materials are being furnished to our regular customers. To help them meet today's new responsibilities, we have added to our productive facilities and gone on a full time schedule. In other words . . . doing everything possible to serve both old customers and new—promptly.

Mica Insulator Company's products include:—Micanite and Super Micanite Built-up Mica Insulations in sheets, tapes, rods, tubes and molded shapes; Lamicoid laminated Bakelite for both electrical and mechanical applications; Empire Varnished Cloths, Tapes and Tubing; and a wide variety of other insulating materials.

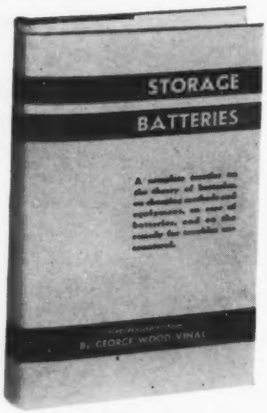
MICANITE . . . SUPER MICANITE
EMPIRE VARNISHED INSULATION
LAMICOID LAMINATED PLASTICS

MICA INSULATOR COMPANY

200 Varick St., New York; 542 South Dearborn St., Chicago; 1276 West 3rd St., Cleveland. Birmingham, Boston, Cincinnati, Los Angeles, San Francisco, Seattle. Montreal, Toronto

A RELIABLE SOURCE FOR ALL YOUR INSULATING MATERIALS

The latest and most authoritative information on all the important phases of Storage Batteries



New Third Edition

STORAGE BATTERIES

By GEORGE VINAL

Chief, Section of Electrochemistry, National Bureau of Standards

From a comparatively unimportant piece of auxiliary equipment, the storage battery has been developed into a very important factor in making the advantages of electric power available in many industries. In the power industry, in transportation, and in communication, batteries serve so many purposes as to justify a book of the scope and breadth of treatment of this one. The present volume is the third edition of a work that first appeared in 1924.

"Storage Batteries" is a general treatise on the physics and chemistry of secondary batteries and their engineering applications. It discusses the subject from the chemical, the physical, and the practical viewpoint. The chemical treatment involves the nature and properties of the materials used in battery construction and the reactions that occur during charging and discharging. The physical includes a study of the electrical input and output, the factors that affect the capacity, and the theory of transformation of chemical energy into electrical energy, or vice versa. The practical part of the work deals with the engineering applications of storage batteries.

464 pages 6 by 9 170 illustrations $5.00

ON APPROVAL COUPON

JOHN WILEY & SONS, Inc.
440 Fourth Avenue, New York, N. Y.

Please send me the following book on *ten days' approval*. If at the end of that time I decide to keep it, I will remit the price plus postage; otherwise I will return it postpaid.
Vinal: Storage Batteries $5.00

Name .....

Address .....

City and State .....

Employed by .....EW 1-11-41

LETTER TO THE EDITOR

First Flexibly Mounted Generator

To the Editor of ELECTRICAL WORLD:

The inference that the Baltimore generator (November 9 issue, page 7) is the first flexibly mounted machine may be confusing to many of your readers who have followed this important development.

Actually the first 3,600-r.p.m. generator with flexible mounting was built and tested at East Pittsburgh during the summer of 1939. This 12,500-kva. generator was installed nearly a year ago (February, 1940) in the Schuylkill station of the Philadelphia Electric Company, although no formal announcement was made. The machine at present produces power for customers' use while loading an experimental turbine. This generator was the first commercial machine using the flexible method for isolating the vibration and reducing noise inherently produced by large two-pole, 3,600-r.p.m. generators. It is based on principles disclosed by Messrs. Laffoon and Rose at Springfield and San Francisco A.I.E.E. meetings May 3-5, 1939, and June 24-28, 1939, respectively.

Since then one 31,250-kva. machine of this design has been placed in service and one 81,250-kva. machine has been shipped. A total of nineteen units, totaling 1,000,000 kva. are being built on customer orders by the Westinghouse Electric & Manufacturing Company.

C. M. LAFFOON, Manager
A. C. Generator Engineering,
Westinghouse Electric & Mfg. Co.

•

Free Training Courses to Be Given by Colleges

Engineers and technical men urgently needed in the defense program will shortly be offered free full-time day and evening courses in a co-operative plan announced by Harvard University, Massachusetts Institute of Technology, Tufts College and Northeastern University. Other engineering schools in the northeast are preparing to offer similar courses. Dean Edward L. Moreland of M.I.T. is regional ad viser on engineering defense training. The committee in charge of the project, which is expected to train about 1,000 students, includes Dean H. M. Westergaard of the Harvard Graduate School of Engineering, Prof. Raymond D.

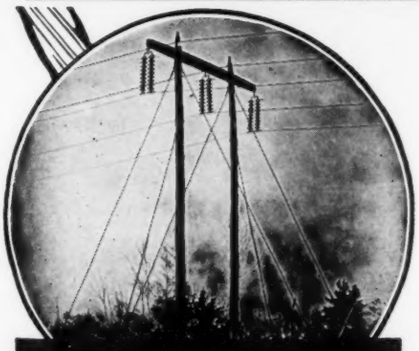
DELTA-STAR
Bus & Cable Connectors
ASK FOR BULLETIN 38-D

TYPE "FR" Clamp Type Reducers

Cast to size interchangeable halves, DURONZE bolts and nuts. Rounded edges prevent conductor stress.

For connecting a smaller tubing to the end of a tubing bus. These connectors carry full rating of extra heavy tubing corresponding to the small end.

DELTA-STAR ELECTRIC CO.
2400 BLOCK FULTON ST. CHICAGO, ILLINOIS.



Crapo
GALVANIZED STEEL
STRAND

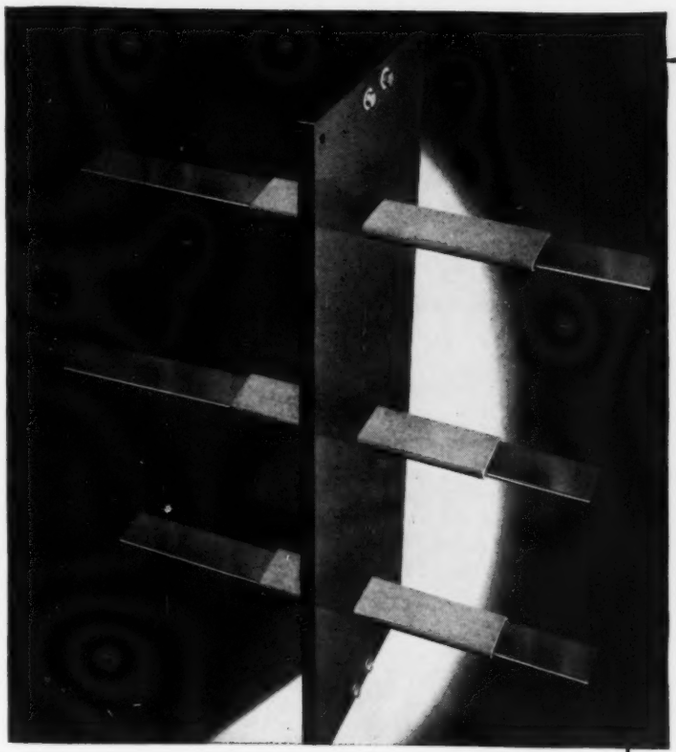
STRENGTH, ruggedness and durability are combined with definite economy in *Crapo* Galvanized Steel Strand. Low first cost, low maintenance expense are matters of record wherever this time-tested product is in use. Available in all standard grades and sizes from representative jobbers throughout the country. Or, write—

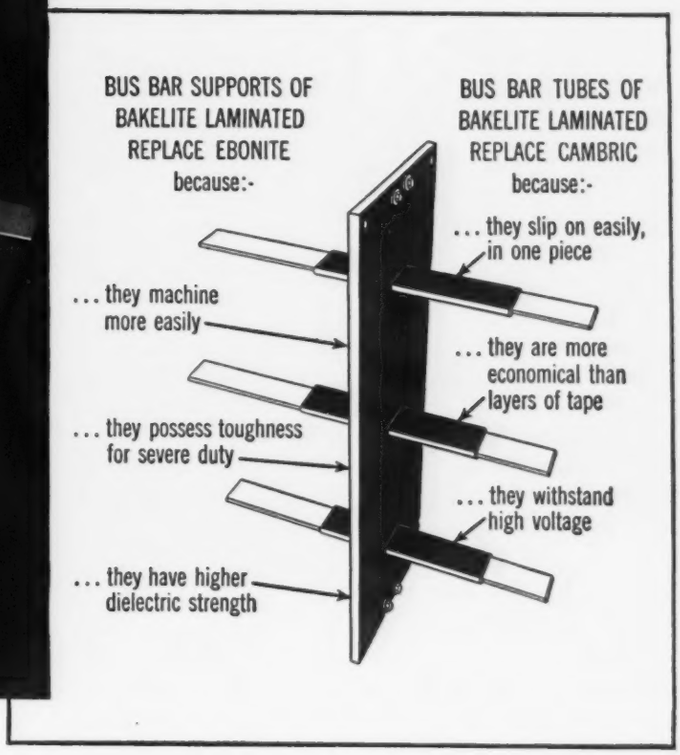
INDIANA STEEL & WIRE CO.
MUNCIE, : : INDIANA

HIGH VOLTAGE INSULATION

Easier to Assemble . . . More Durable

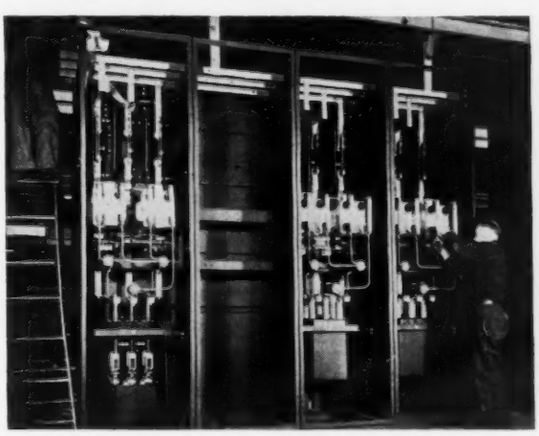
WHEN MADE OF "BAKELITE" LAMINATED PLASTICS




BUS BAR SUPPORTS OF BAKELITE LAMINATED REPLACE EBONITE because:-
. . . they machine more easily
. . . they possess toughness for severe duty
. . . they have higher dielectric strength
BUS BAR TUBES OF BAKELITE LAMINATED REPLACE CAMBRIC because:-
. . . they slip on easily, in one piece
. . . they are more economical than layers of tape
. . . they withstand high voltage

RECOGNIZED by manufacturers as superior insulating materials, BAKELITE Plastics possess, also, many other important properties that contribute not only to long service-life but to simplified production and assembly as well.

In the high voltage switch gear illustrated, BAKELITE Laminated Plastics serve two vital needs.



Bus bar insulation tubes, that formerly were formed by multiple cambric taping, are now made in one rugged piece of BAKELITE Laminated. Easily slipped on the bus bars, they eliminate a tedious and time-consuming assembling operation. Bus bar support panels, although tougher than ebonite, are now more accurately and more easily machined from BAKELITE Laminated sheet stock.

It will pay you to know more about the many types of BAKELITE Plastics now available for electrical insulation requirements. Write for illustrated booklet 9P, "New Paths to Profits."

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation
UCC
30 EAST 42nd STREET, NEW YORK

BAKELITE
TRADE MARKS
The word "Bakelite" and the identifying products Symbol are registered trade-marks of Bakelite Corporation

PLASTICS HEADQUARTERS

20 Years Experience in Life Extension of Electrical Insulation

DOBLE
AGAIN PIONEERS

A NEW TEST FOR OLD OIL

Another new standard in the making by the recognized authority on insulation testing in the field.

•

DOBLE ENGINEERING COMPANY
MEDFORD HILLSIDE, BOSTON, MASS.

Douglas of M.I.T., Dean W. C. White of Northeastern and Dean H. P. Burden of Tufts.

Admission requirements include at least three years in an accredited engineering school or its equivalent. The curricula of the day courses will be substantially equivalent to one full college term of sixteen weeks and the subjects include airplane power plants and structures, camp sanitation and water supply, building construction, defense production and co-ordination, naval architecture, marine engineering, meteorology, mapping and surveying (both land and aerial). The evening courses will last from twelve to twenty weeks and will cover many subjects of importance in industrial, electrical, mechanical, and military fields associated with equipment and machinery production and use. Applicants should address by letter the Engineering Defense Training Bureau, Room 7-102, Massachusetts Institute of Technology, Cambridge.

•

AC Grounds on Water Pipes Do No Damage

The Technical News Bulletin of the National Bureau of Standards reports that the technical subcommittee of the American Research Committee on Grounding has been investigating complaints covering damage to water systems in houses and pollution of water flowing in the pipes.

It was stated that the subcommittee has issued a summary report covering 21 complaints in seven communities, showing that in none of these cases was there evidence to indicate that the flow of alternating current over water pipes or mains by itself has caused damage to the piping or to the water flowing in the pipes.

On the other hand, it was stated, the investigations revealed differences in the chemical composition of the water supplied to a given user; differences in impurities of the metal of which the pipes are made; galvanic action resulting from the indiscriminate use of many different metals, and variations in their composition; differences in the temperature of the hot water supply, and in the rate and amount of water drawn from the mains; and many other factors.

"It is not possible at this time to state that damage from alternating current flowing over water pipes could not occur," it was said. "For the future, the grounding committee expects to continue its investigation of all complaints of water contamination where grounding of electric circuits is involved, to determine, if possible, whether there is any relation in normal practice

EVERSTICK ANCHORS...

Provide dependable anchoring when poles are subjected to unusual strains from storms. Made of tough, certified, rust resistant, malleable iron for extra strength and holding power. Write for new bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

DILLON TRACTION DYNAMOMETER

0-500 lbs. to 0-15000 lbs.

$50.00 to $117.50 *including carrying case and shackles*

W. C. DILLON & COMPANY
5410 W. Harrison St. Chicago, Ill.

ACE of PLUGS!

COLOR TELLS SIZE
EASY SELECTION
QUICK INSPECTION

The shock and vent-proof top is safe—no glass to cut fingers—and their dependability means less loss of revenue.

"YOU CAN'T GO WRONG WITH COLORTOPS"

TRICO FUSE MFG. CO. Milwaukee, Wis.

KNOW ELECTRICITY AS EXPERTS KNOW IT

—AND GET AN EXPERT'S PAY

What about your future? Who is safe today? Surely not the man who is contented to stand still! Know your job thoroughly—prepare yourself for jobs ahead. To do just this thousands of men have used

The CROFT Library of Practical Electricity

6 volumes, 2155 pages—only $16.50

• The Croft Library is a complete electrical educator. It is founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. It is jammed from cover to cover with the kind of hard-headed facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 59,000 highly paid electrical workers and engineers.

• Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from estimating it, to completion.

NO MONEY DOWN
EASY PAYMENTS
10 DAYS' FREE EXAMINATION

Fill in and mail the coupon attached and we will send you the entire set of six volumes for ten days' Examination. We take all the risk—you assume no obligation. If you decide to keep the books, send $1.50 in ten days and the balance at the rate of $3.00 a month.

SEND THE COUPON NOW
AND SEE THE BOOKS FOR YOURSELF

EXAMINATION COUPON

McGRAW-HILL BOOK CO.
330 W. 42nd St., New York

You may send me the six volumes of the Croft Library of Practical Electricity for 10 days' examination. I agree to return the books, postpaid, in ten days or remit $1.50 then and $3.00 a month until the special price of $16.50 has been paid.

(To insure prompt shipment, write plainly and fill in all lines.)

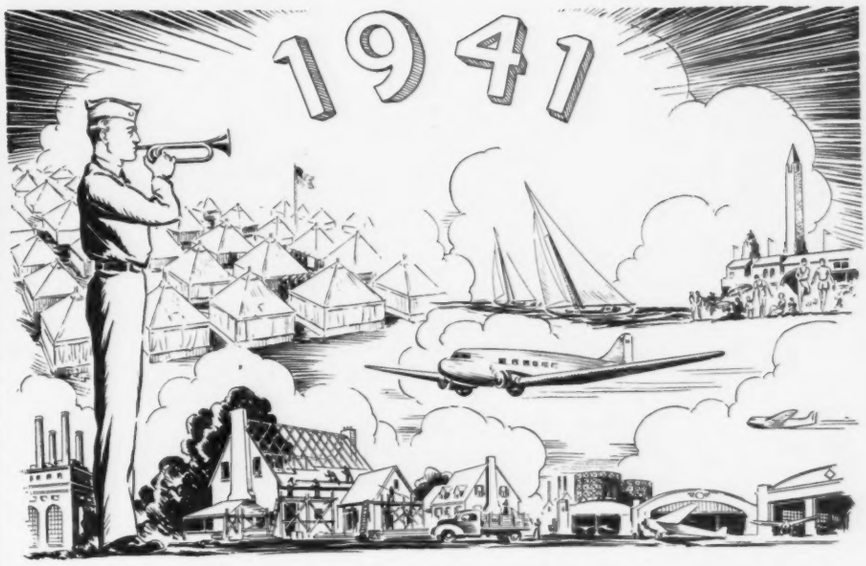
Name .....

Home Address .....

City and State.....

Position .....

Name of Company.....W. 1-11-40



LONG ISLAND LOOKS AHEAD!

AGAIN a New Year dawns upon Long Island to illuminate prospects of greater growth and accomplishments.

With industries humming, with new homes being built by the thousands, with resort areas looking forward to the best season in years, and with camps and highways resounding to the martial tread of America's new citizen army, Long Island can expect big things in nineteen hundred and forty-one.

With this progress of our Island there goes hand in hand the responsibility of our people and our business institutions. What we need today more than ever is the winning spirit of team play . . . the constant cooperation and complete unison necessary to gain the victory of harmonious community life.

The Long Island Lighting Company realizes that as a public utility giving real service it must keep in step with the territory it serves; equipment and facilities must be extended, plants enlarged, production expanded and there must be an alert participation in community affairs. Only through the growth and prosperity of the community can it too achieve prosperity.

For our Company and our organization of faithful employees, we pledge our sincerest effort in the advancement of Long Island.

Let us all look ahead together in 1941!

LONG ISLAND LIGHTING COMPANY

And Subsidiary Companies

Queens Borough Gas & Electric Company
Kings County Lighting Company
Nassau & Suffolk Lighting Company
Long Beach Gas Company, Inc.

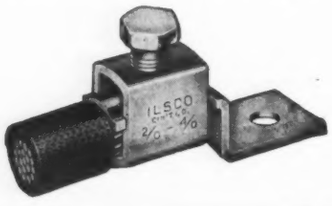
All Kinds
OF PRECISION SPRING
DYNAMOMETERS

For Determining
·BREAKING STRAINS·
TENSIONS & TRACTIONS

WRITE FOR CATALOGUE AND
SEND YOUR PROBLEMS TO

JOHN CHATILLON & SONS
85 TO 93 CLIFF STREET
NEW YORK, N.Y.
Est. 1835

ILSCO
SOLDERLESS CONNECTORS
HAVE YOU TRIED
The New Ilsco Lugs?



BUILT FOR OVERLOADS!

The new design — as passed by the Underwriters' Laboratories May 1, 1940.

Write for Samples today, —Along with the New Catalog.

.....*No Obligation*.....

ILSCO COPPER TUBE
AND PRODUCTS, INC.
5629 MADISON ROAD — — CIN., O.

between superimposed alternating currents and effects on water pipes and the water itself.

•

Idaho Reports Sharp Rural Service Rise

Few states in the Union have enjoyed such early and complete electrification as Idaho, reports Hobart Beresford, agricultural engineer with the University of Idaho agricultural experiment station and project director of the Idaho committee on the relation of electricity to agriculture. Farm electrification in Idaho had its beginning in the early 1900's but most spectacular development has been in the last fifteen years.

Today Idaho ranks tenth in the United States in total farm electrification. The state's percentage of electrified farms is 64.2, and as of June, 1940, there were 26,914 farms served by 7,043 miles of rural power lines. In the Twin Falls area more than 90 per cent of all farms are electrified. In 1915 only 2,000 farms were served.

Mr. Beresford reported that over 87 per cent of Idaho's farms with dwellings valued at more than $500 now have electricity, which ranks the state fourth among the nation on this basis.

Information concerning Idaho's rural electrification is contained in a bulletin, "Farm Electrification in Idaho," which can be secured from county agents or from the director of the Idaho Agricultural Experiment Station, Moscow.

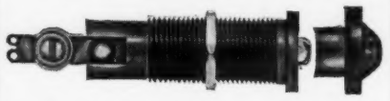
•

Will Borrow from Five Banks to Refinance

According to amendment filed with its recent application to the Securities and Exchange Commission, the Commonwealth & Southern Corp. has made arrangements to borrow $17,000,000 from five banks: Bankers Trust Co., $5,000,000; Chase National Bank, $5,000,000; National City Bank, $3,000,000; First National Bank, $2,500,000; Central Hanover Bank & Trust Co., $1,500,000. The loan will mature semi-annually over a ten-year period and carry interest at the rate of 2⅛ per cent per annum.

This is part of the transaction to retire $38,386,000 principal amount of Southeastern Power & Light Co. 6 per cent debentures due September 1, 2025; $77,750,000 principal amount of Penn-Ohio Edison Co. 5½ per cent debentures due February 1, 1959, and $5,721,500 principal amount of Penn-Ohio Edison Co. 6 per cent debentures, due November 1, 1950.

NEW ALL-PLASTIC
SWITCHBOARD LAMP
FOR SINGLE HOLE MOUNTING



Type T2 Unit. The shell is molded in the color of the lens-cap to prevent error . . . The Unit is furnished with a series resistor assembly for operation on voltages up to 440.

Write for Ten Page Catalog

GRAYBAR ELECTRIC CO.
H. R. KIRKLAND CO., Morristown, N. J.

"IMPROVED METAL SNATCH"
Another
"ANVIL BRAND" BLOCK
In Favor With Linesmen

SEND FOR CATALOGUE

COMPLETE LINE TO
WESTERN BLOCK CO.
Market Street
Lockport, N. Y.
NEW YORK CITY
74 Murray St.
CHICAGO
34 N. Clinton St.

G.C.A.
Lamp Replacers
Lamp Base Removers
Cartridge Fuse Tongs
Switch Hooks

Send for Catalogue

We have been making safety tools for 24 years

THE G. C. A. Manufacturing Co.
Pittsfield, Mass.

HIGH GRADE
HARD PORCELAIN
FOR
Electrical Specialties
High and Low Voltages

IMPERIAL
PORCELAIN WORKS
TRENTON, NEW JERSEY

Canada Power Units Increase 295,226 Hp.

A survey of hydro-electric progress in Canada during 1940 indicates extensive activity in the provision of power for industry, according to a report of T. A. Crerar, Minister of Mines and Resources, Ottawa.

Mr. Crerar said that the horsepower capacity of hydro-electric generating equipment installed in new plants and as additional equipment in existing plants exceeds that of any of the preceding five years. In addition power plants which will include an even greater installation are under preliminary or final construction, he declared.

"Widespread extensions of transmission and distribution facilities have been made to serve new war-time industries and military establishments and to meet ordinary civilian demands for mining, industrial and domestic use, both urban and rural," Mr. Crerar said.

Adds 295,226 Hp.

New water-power installations during 1940 totaled 302,790 hp. Adjusting this figure because of the inclusion in the 1939 totals of two installations not actually operating until after January 1, 1940, and because of the omission of two 1939 installations not reported before the end of that year gives a net addition to the total installation obtaining at the end of 1939 of 295,226 hp. and brings Canada's total hydraulic installation as of January 1, 1941, to 8,584,438 hp.

Mr. Crerar stated that much of the increase was due to additions to existing installations, but two new stations were completed and brought into operation during the year. The larger of these was the 178,000-hp. plant of the St. Maurice Power Corp. (owned jointly by Shawinigan Water & Power Co. and the Brown Corp.) at La Tuque on the Upper St. Maurice River, in the Province of Quebec, and the other, the 7,500-hp. Hollow Bridge plant of the Avon River Power Co. on Black River in Nova Scotia. The larger additions to existing plants included a 53,000-hp. unit installed in the Beauharnois Light, Heat & Power Co.'s station on St. Lawrence River and two units of 25,000 hp. each in the West Kootenay Power & Light Co.'s Upper Bonnington station on Kootenay River in British Columbia.

It was reported by Mr. Crerar that notwithstanding progressive monthly reductions in the sales of secondary power for use in electric boilers and for export to the United States, there is every indication that the total output of the central stations will reach a new record total of more than 30,000,000,000 kw.-hr.

BIAS TAPES *with plenty of* STRETCH!

ACME bias tapes fit snugly around corners, into slots and over uneven surfaces because they have exceptional flexibility (stretch), and the tensile strength to stand the pull. These qualities are due to an Acme-developed process of applying pure vegetable oil varnishes of Acme formula to highest grade cotton fabric. Available in bias or straight tapes and rolls up to 36″ wide—yellow or black. Samples if desired.

Acme Wire PRODUCTS

The Acme Wire Co., New Haven, Conn.
VARNISHED INSULATIONS—COILS—MAGNET WIRE

for **EASE . . . ECONOMY . . . EFFICIENCY . . .**

In Making Underground Splices—Use
NATIONAL Split Tinned COPPER CONNECTORS

The use of National Connectors for making underground Cable splices, saves time, and increases accuracy and efficiency. These connectors are made exact to size of the best grade pure soft drawn copper in a size range from 12 B. & S. solid to 2,500,000 C.M. They have a guaranteed conductivity of 98% or better. You'll find that it will pay to standardize on "Nationals" for underground jobs.

THE NATIONAL TELEPHONE SUPPLY COMPANY
5100 Superior Avenue • • Cleveland, Ohio

PROFESSIONAL SERVICES

Consulting Accounting Valuations — Management Appraisals Construction — Designing Testing Financing — Inspections Cost Analysis Investigations

N. W. ATTERBURY & CO.
Consulting Engineers
General Engineering Service
P. O. Box 1793 Pittsburgh, Pa.

E. T. L.
TESTS
Electrical, Chemical, Mechanical, Photometric
INSPECTIONS Materials and Supplies
RESEARCH Private Labs. for Clients
Electrical Testing Laboratories, New York, N. Y.

SANDERSON & PORTER
ENGINEERS
for the
FINANCING—REORGANIZATION—DESIGN—CONSTRUCTION—
of
INDUSTRIAL and PUBLIC UTILITIES
Chicago New York San Francisco

BARKER & WHEELER
Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.
11 Park Place, New York City
36 State Street, Albany, N. Y.

FRANK F. FOWLE & CO.
Electrical and Mechanical
ENGINEERS
35 East Wacker Drive Chicago, Ill.

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
Chicago, Ill.

BLACK & VEATCH
Consulting Engineers
Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.
4706 Broadway, Kansas City, Mo.

HOOSIER ENGINEERING COMPANY
Erecting Engineers
Transmission Lines, Substations
46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

SPOONER & MERRILL, INC.
Consulting Engineers
Design—Supervision of Construction
Reports—Examinations—Valuations
20 North Wacker Drive, Chicago, Illinois

E. J. CHENEY AND CO.
Engineers and Consultants
61 Broadway New York

WILLIAM S. LEFFLER
succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers — Economists
Public Utility Management Problems
Economic Audits for Selective Load Building
Balanced Domestic Load Development
Cost Analysis—Rate Cases
30 East 42nd Street—New York

STEVENS & WOOD
Incorporated
ENGINEERS AND CONSTRUCTORS
30 Broad Street New York

HUGH L. COOPER & CO.
General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.
101 Park Ave. New York

J. H. MANNING & COMPANY
ENGINEERING SERVICES
120 BROADWAY NEW YORK
FIELD BUILDING CHICAGO

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

DAY & ZIMMERMANN, INC.
ENGINEERS
Design - Construction - Management
Investigations and Reports
NEW YORK PHILADELPHIA Packard Building CHICAGO

DANIEL W. MEAD F. W. SCHEIDENHELM
Consulting Engineers
Hydro-Electric Development, Dams, Water Supply, Flood Control. Engineering Problems relating to Water Rights and Water Power Law. Appraisals.
New York City, 50 Church St.

A. Y. TAYLOR AND COMPANY
Municipal and Industrial Consulting Engineers
Reports, Appraisals, Design Supervision of Construction
2 So. Central Ave. Clayton, Mo.

ROBERT E. FOLEY
Erecting Engineer
Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines
48 Griswold St. Binghamton, N. Y.

ARTHUR L. MULLERGREN
Public Utilities Consultant
Management
Fairfax Bldg. Kansas City, Mo.

THE J. G. WHITE ENGINEERING CORPORATION
Engineers — Constructors
New York, N. Y.

FORD, BACON & DAVIS, Inc.
Engineers
DESIGN • CONSTRUCTION
VALUATIONS • REPORTS
New York
Philadelphia — Washington — Cleveland — Chicago

Recording & Statistical Corp.
BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
Bill Frequency Analyzer
102 Maiden Lane New York

READERS MAY CONTACT

the consultants whose cards appear on this page with the confidence justified by the offering of these special services nationally.

Esauing States' Rights

[*Continued from page 120*]

But the simple fact is that Baker had not changed in the slightest degree. He was still the same sort of liberal he was when he refused to support Harmon and backed Wilson. Or when he was roundly denounced by the "practical" conservatives when he was Secretary of War.

The "liberal" current had swept past Baker. Where will it reach in a few more years? What will be the next step of encroachment on local rights in the government's fight to acquire the electric industry? If the high court can assume that a river is navigable within the meaning of the constitution for power purposes because it could be dredged, canalized and the rocks removed, is it a very long step to the assumption that a local electric company could get its power from some navigable stream—and hence is subject to regulation under the commerce clause of the constitution? Not to mention national defense!

•

Two Cities Service Units Plan Private Refunding

Arrangements have been made by two operating properties of the Cities Service Power & Light Co. for private sale of $8,150,000 of 3½ per cent bonds and debentures to an insurance company to refund outstanding obligations.

East Tennessee Light & Power Co. plans to sell $5,000,000 of 3½ per cent first mortgage bonds and $1,000,000 of 3½ per cent debentures. Proceeds would be used to refund various higher interest bearing obligations of the company and two subsidiaries.

Durham Public Service Co. proposes to sell $2,150,000 of 3½ per cent first mortgage bonds also for the purpose of refunding higher interest bearing bonds.

Through these proposed refundings East Tennessee Light will save approximately $125,000 a year in fixed interest requirements and Durham Public Service will reduce carrying charges on its funded debt about $50,000 annually.

•

Will Start New Building

The Kentucky-West Virginia Power Co., Ashland, Ky., will soon let contracts on the construction of a three-story and basement office building to cost about $150,000.

One Million Through-bolt Guy Hooks

During the month of December 1940 the acceptance in the field of M.I.F. Guy Hooks for through-bolt guying construction passed the 1,000,000-mark. We feel this endorsement by Companies constituting more than one-half the operating capacity of the U. S. and Canada means more than what we say about them.

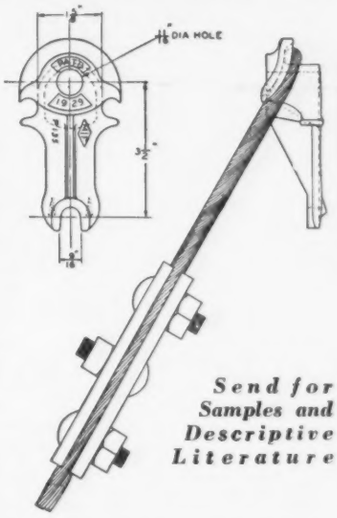
1. *Simplification of Guying Specifications* results from the use of M.I.F. Through-bolt Guy Hooks as they are used with stock through-bolts and lags.

2. *Economical Construction* results as the patented M.I.F. Guy Hook is cheaper than other acceptable through-bolt guying devices developing equal performance under test. Accessory Curved Ribbed Washers, Eye Nuts, Bolt Eyes, and High-strength Thimbleless Eye Anchor Rods are all competitively priced, or better. The durability of these galvanized malleable castings is beyond question.

3. *Safe Construction* results from using M.I.F. Guy Hooks. As the guy loop is made up on the ground and then carried up the pole and placed over the Guy Hook retaining ear, protection from contacting live wires is more readily assured. There are no records of failures in service.

4. *No Regrets* result from proper through-bolt guying. At least 95% of all sales of 100 or more M.I.F. Guy Hooks have led to consistent repeat orders.

To Transmission and Distribution Engineers, not now using these M.I.F. Guy Hooks and Accessory Through-bolt Guying Devices, we extend an invitation to write for samples *without obligation*. Four sizes available.



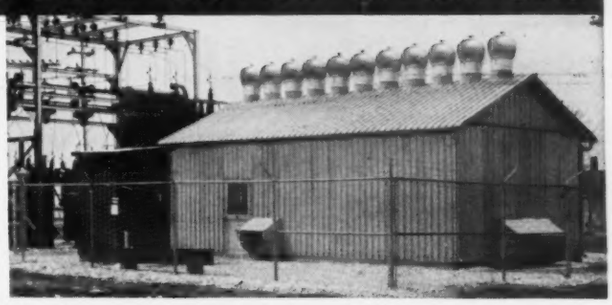
Send for Samples and Descriptive Literature

Misc. M.I.F. Pole Hardware Specialties: — *Williams Pole Mounts — Pole Stubbing Clamps — Aerial Cable Messenger Clamps and Insulated Hangers — Malleable Secondary Racks and Clevises — Tubular Pole Fittings — Transformer Hanger Plates for Through-bolt Mounting — Malleable Crossarm Gains — Screw Anchors — Sidewalk Guy Fixtures and Alley Arm Braces — Guy Strand Dispensing Holders — Through-bolts and Double-arming Bolts, etc.*

MALLEABLE IRON FITTINGS COMPANY
Pole Hardware Dept. [Factory and New England Sales Office] **Branford, Connecticut**
New York Sales Office: Thirty Church Street
Canadian Mfg. Distributor:
LINE & CABLE ACCESSORIES, Ltd., Toronto

3-WAY SAVINGS SPUR TREND TO STEEL
IN HOUSING UTILITY OUTPOST OPERATIONS

You, Too, Can
Expand Your Plant with Minimum Investment
★
Install in Days Instead of Weeks!
★
Readily Insulate, Heat or Air-Condition



Structurally Strong, Fire-Safe, Permanent...
SYNCHRONOUS CONDENSER HOUSE

Typical of the growing use of Butler Steel Buildings in the public utility field is this one—housing synchronous condensers for voltage control. It is 16'x34' and ventilated for air displacement of 20,000 cu. ft. per min.

Twenty-five years of engineering has developed factory fabricated steel units that quickly bolt together to house, in small units or large, the space needed for expanding operations or storage.

Free! **Send for Butler Book of Steel Buildings** showing a hundred installations in a score of industries and an outline of your needs.

BUTLER
READY-MADE STEEL BUILDINGS
BUTLER MANUFACTURING COMPANY

BUTLER MANUFACTURING COMPANY
Division EW—Kansas City, Mo. Minneapolis, Minn.

( ) Send Steel Building Book ( ) data on building

.....ft. x .....ft. x .....ft.

Firm Name .....

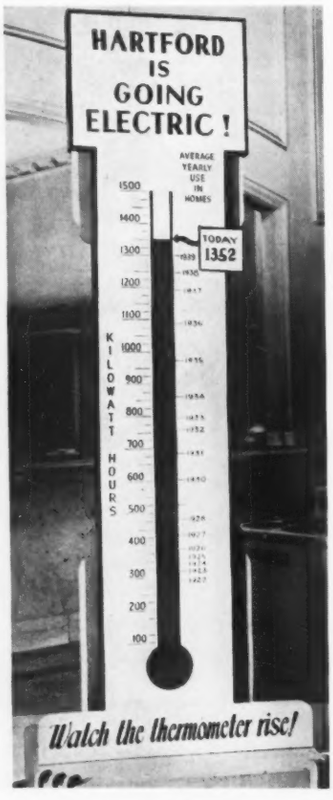
Address .....

City ..... State.....

21
YEARS
OF
PROGRESS

Average USE
in Homes
390% Up!

Average RATE
in Homes
61% Down!



THE
HARTFORD
ELECTRIC LIGHT
COMPANY

Personnel Changes Made in G. E. Lighting Group

F. M. Spaugh of Lynn, Mass., has been transferred to Schenectady to assist F. D. Crowther, General Electric lighting section sales manager, effective January 1, according to A. F. Dickerson, manager of the G. E. lighting division. Mr. Spaugh will be in charge of the sales of floodlighting, traffic control and signal equipment.

J. W. Howard of Schenectady will replace Mr. Spaugh at the G. E. Lynn River works as commercial representative of the lighting division. C. C. MacAllister, formerly in charge of the sale of traffic control and signal equipment at Schenectady, will assist in the design of that equipment and will have headquarters at the Lynn River works.

•

▶ JOHN E. BOUCHARD, appliance manager for the Massachusetts Gas & Electric Light Supply Co., Boston, has resigned to join the Graybar Electric Corp., Inc., as appliance supervisor for Rhode Island, working out of the Providence office. Mr. Bouchard has had wide experience in the appliance field.

▶ FRED A. ROGERS has been devoting himself exclusively to consulting engineering and testing work since his recent retirement from the deanship of engineering at Lewis Institute. His tests are conducted at the Lewis Institute Laboratories in the name of the Armour Research Foundation, with which he is now affiliated. His office is at 8 South Dearborn, Chicago. Mr. Rogers is well known in the Chicago area as a consulting and testing engineer and as an educator.

▶ JOHN E. OTT, who has been connected with the Acme Steel Co., Chicago, for eighteen years, has been appointed manager of the Archer plant, where he will be in charge of production, warehousing, shipping, maintenance and engineering. W. C. Childress, formerly in charge of production and engineering at the Archer plant, has resigned.

▶ ORVILLE M. DUNNING, manager of the research department of the Ediphone division of Thomas A. Edison, Inc., Orange, N. J., and formerly active in radio and sound engineering for the Sonora Phonograph and General Electric companies, has been appointed chief engineer of the Gray Manufacturing Co., Hartford, Conn. In his new position he will devote the major portion of his time to the commercial perfection of the company's Audograph, a new multi-purpose electrical recording machine. He will move to Hartford shortly.

SEARCHLIGHT SECTION

(Classified Advertising)

Employment—Business Opportunities—Equipment—Used or Resale

UNDISPLAYED RATE:
10c a word, minimum charge $2.00; Positions Wanted (full or part-time salaried employment only) ½ the above rate.

DISPLAYED RATE:
The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

POSITIONS VACANT

WANTED ENGINEER—With experience in design, maintenance and construction of overhead electric distribution and transmission lines; capable of supervising others engaged on this type of work. P-845, Electrical World, 330 W. 42nd St., New York, N. Y.

WANTED ASSISTANT ENGINEER — experienced in design and maintenance of overhead electric distribution lines, preferably under 35 years of age. P-846, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 31 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

Executives and Technical Men. Qualified candidate desiring $2,500 to $20,000 positions may contact employers through our confidential services, established 25 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

(See also "Selling Opportunities Wanted")

DISTRIBUTION SUPERINTENDENT OR MANAGER, twenty years experience on design, specifications, contracts, construction and operation of overhead and underground radial and network distribution systems and general utility engineering and management. Age 40. Married. 1920 grad. Will travel. PW-824, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER experience in construction and maintenance in large industrial plant—now employed desires change. PW-839, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

INDUSTRIAL ENGINEER—college graduate. Age 45. Past 15 years devoted to valuation engineering of public utility properties and equipment. Eastern U. S. prefered. PW-841, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEER—Experience in construction and maintenance in large industrial plant—capable of superintending electrical installation in new industrial plant, desires change. PW-643, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

COMMERCIAL MANAGER, eighteen years' experience in the operation of Merchandising and New Business Departments of combination companies. Thoroughly competent in the preparation of rates, contracts, and municipal agreements. Present connection with company grossing four million dollars annually desires to make connection with larger company. Salary secondary if advancement based on merits and not seniority. PW-847, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

CIVIL AND HYDRAULIC ENGINEER—Engineering graduate with legal training, 15 years experience on investigations and reports, design and cost estimating for dams, hydro-electric plants, and flood control projects. PW-848, Electrical World, 330 W. 42nd St., New York, N. Y.

(Continued on the opposite page)

YOU CAN EARN MORE
BE A METER EXPERT
THOROUGH TRAINING by mail under personal instruction of meter experts.
EARN $2,000 to $4,000 per year.
25 years' experience with Successful Graduates everywhere. LOW COST—EASY TERMS.
Free Booklet Without Obligation. Write Now!
Ft. Wayne Correspondence School, Ft. Wayne, Ind.
Dep't. 11